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CANCER AND OTHER TUMOURS OF THE STOMACH

BY THE SAME AUTHORS.

STUDENT'S GUIDE TO MEDICAL DIAGNOSIS. Ninth Edition.

OUTLINES OF MEDICAL TREATMENT. Fifth Edition.

ULCER OF THE STOMACH AND DUODENUM.

DYSPEPSIA: ITS VARIETIES AND TREATMENT.

(In preparation.)

CANCER AND OTHER TUMOURS OF THE STOMACH

BY

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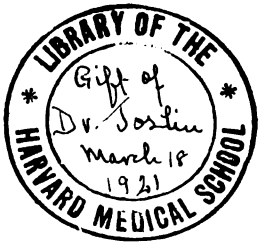

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PREFACE

THE present volume is divided into two parts, the first of which deals with Gastric Carcinoma, and the second with the various other Tumours which affect the Stomach and the Duodenum.

The general description of the morbid anatomy of the malignant disease is based upon the post-mortem records of 3,679 cases which we collected from different sources; while the more special phenomena connected with its pathology are derived from an analysis of 265 cases which were examined after death at the London Hospital and the London Temperance Hospital. With three exceptions the illustrations have been prepared for us from specimens contained in the museums of the aforementioned hospitals or in that of the Royal College of Surgeons.

The old method of classifying gastric carcinomata according to their macroscopical appearances has been responsible for so many erroneous conclusions respecting their pathology and clinical aspect that we have adopted the nomenclature suggested by Drs. Perry and Shaw in their admirable article in the Guy's Hospital Reports, and have employed the terms 'scirrhus,' 'medullary' and 'adeno-carcinoma' to indicate growths which possess a definite histological structure. The substitution of the microscope for the naked eye has also had the effect of demonstrating that the infectivity of a carcinoma of the stomach is infinitely more rapid and diffuse than the presence of visible metastases has been held to indicate; and we are convinced that much of the non-success that has attended the performance of pylorectomy has arisen from a deficient appreciation of the widespread nature of the disease.

Since the histology of the gastric complaint does not differ materially from that of carcinoma of other organs of the body, we have contented ourselves with a general sketch of the subject, and for a more detailed description would refer the reader to one of the numerous text-books on pathology.

The investigations into the etiology of gastric carcinoma have been conducted upon somewhat different lines from those which custom has ordained, with the result that many of our conclusions differ materially from those of previous writers. We have endeavoured to show that the long-established teaching concerning the sex and age incidence of the disease has been founded upon errors which almost invariably accrue from the exclusive employment of hospital statistics, and that not only is the complaint equally common in the two sexes, but that the liability to it increases with each decade of life until about eighty years of age. With regard to the much-discussed question of the increase of carcinoma, it would appear that during the last four years there has been no appreciable augmentation of the number of those dying from the gastric lesion in this country. For much of the data by which we have sought to establish these and other kindred facts we are indebted to Dr. Tatham, of the General Register Office, who has not only afforded us a large amount of special information, but has given us much valuable help in the arrangement of our own statistical material.

Another point of interest in this connection is the varying mortality from cancer of the stomach in London at different periods of the year. We had long been aware that the disease was particularly rife in the wards of the London Hospital during the summer months, but until we analysed the figures we did not fully appreciate the fact that more than 60 per cent. of the total deaths occurred between June and November, while the admissions to the hospital during the winter months only constituted about 14 per cent. of the whole number for the year. Should further and more extended inquiries confirm these conclusions, much light may possibly be thrown upon the etiology of the disease.

The symptomatology has been written from the study of 154 cases which were treated and examined after death at the London Hospital and the London Temperance Hospital. The adoption of this procedure affords, we believe, a more accurate idea of the clinical features of the complaint as it appears in everyday practice than could be obtained from the records of private experience, which are apt to include an undue proportion of obscure or exceptional cases. Each separate symptom is considered in reference to the condition, situation, and extent of the morbid growth, and the conclusions arrived at have been expressed as far as possible in the form of tables, so as to prevent unnecessary reiteration. Only such cases are quoted in full as were deemed necessary to emphasise some fact of unusual interest, and all details which were not strictly relevant to the subject have been omitted. As the work has necessarily been written from the standpoint of a physician, we have merely sought to indicate the various conditions which in our experience seem to warrant or to contra-indicate surgical interference, and have left all discussions relative to operative technique to those who are better qualified to deal with the subject.

In the Second Part the various Tumours of the Duodenum are considered, as well as those of the Stomach, and special attention is drawn to the symptoms and diagnosis of carcinoma of this portion of the digestive tract. Sarcoma of the Stomach, although comparatively rare, is a subject of increasing importance, and the success that has attended the removal of the spindle-celled variety gives hope of an ultimate cure being effected in many of the cases. Gastric Syphilis is another disease which has hitherto attracted less attention than it deserves, and there is little doubt that a better knowledge of its symptomatology would result in the cure of many of those troublesome cases of relapsing ulcer or chronic gastritis which defy the ordinary methods of treatment.

The chapters which deal with Polypi, Benign Tumours and Cysts of the Stomach are of the nature of clinical studies, owing to the rarity of the diseases of which they treat and

the obscure nature of the symptoms and physical signs which were observed in the cases recorded. Hair-balls and Gastroliths are, strictly speaking, tumours *within* rather than *of* the stomach; but the fatality which has attended them in the past, owing to a deficient knowledge of their physical signs, has induced us to devote a special chapter to the subject of Gastric Concretions.

In conclusion, we would tender our grateful thanks to Dr. Tatham for his invaluable help; to Mr. C. H. Leaf and Mr. L. Galsworthy for several drawings they kindly prepared for us; to Dr. Murrell for some statistical facts relative to cancer of the stomach at the Westminster Hospital, and to the Council of the Royal College of Surgeons, the College Board of the London Hospital, and the Board of Management of the London Temperance Hospital, for their kind permission to utilise the material contained in their respective museums.

29 HARLEY STREET:
October 15th, 1902.

HISTORICAL INTRODUCTION

CANCER of the stomach has been known from the earliest times, but its symptoms were usually confused by the ancient writers with those of other forms of abdominal disease. Several instances in which the morbid anatomy of the complaint was studied appear in the medical literature of the sixteenth and seventeenth centuries, but no detailed description of the disease was attempted until after the publication of a memoir upon the subject by Morgagni in 1761.

The first two decades of the nineteenth century witnessed a remarkable revival of pathological inquiry, and an accurate description of encephaloid cancer was published by Laennec in 1812, which was followed in 1816 by the differentiation of colloid cancer by Otto. A few years later Cruveilhier and Carswell published their celebrated works upon pathological anatomy, which included many admirable drawings of malignant growths of the stomach.

Until 1851 only three varieties of the disease were recognised, namely, scirrhus, encephaloid, and colloid; but in that year the microscopical features of the cylindrical-celled epithelioma were described by Reinhardt, and were subsequently investigated more fully by Virchow and Förster.

Since 1770 numerous treatises have been written upon the clinical aspect of carcinoma of the stomach, but it was not until 1812 that an attempt was made, by Bayle and Cayol, to offer a complete description of the various symptoms and signs of the disease. Statistical inquiries were first instituted by Brinton, who carefully analysed a large series of cases which

he had collected from various sources, and formulated several conclusions concerning the etiology and symptomatology of the complaint, which are of much value even at the present time. The discoveries of Golding Bird and von den Velden concerning the diminished secretion of hydrochloric acid in cancer of the stomach gave a great impulse to the chemical investigation of the morbid processes of digestion, and much interesting and important work in this branch of diagnosis has been accomplished by Riegel, Boas, Ewald, and others.

The distinction between malignant and benign tumours of the stomach was first established by Andral, Laennec, and other great pathologists of the early part of last century, while the differentiation of sarcoma from carcinoma is due to the labours of Virchow. The extreme rarity of innocent growths and the difficulties attending their diagnosis formerly caused them to be regarded as mere pathological curiosities, but the recent advance of gastric surgery has shown that they possess considerable importance from a clinical point of view. The subject of syphilis of the stomach has received very little attention, although its existence was recognised and its symptoms and treatment carefully studied by Andral nearly a century ago; and the same remark applies to the various concretions met with in the organ, the first example of which was described by Baudamant in 1777.

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PART I

CARCINOMA OF THE STOMACH

CHAPTER I

MORBID ANATOMY AND HISTOLOGY

TUMOURS of the stomach may be classified as benign and malignant. The former are comparatively rare, and most of them are merely pathological curiosities. The latter constitute nearly 94 per cent. of all the tumours of the viscus met with on the post-mortem table, and more than 98 per cent. of those which can be detected during life. It is therefore advisable to consider, in the first place, those neoplasms which from their extensive growth and destructive character must be regarded as diseases of primary importance, and subsequently those which are either devoid of clinical interest, or at most are productive of symptoms of an obscure nature and of irregular occurrence.

It is usually the custom to describe a malignant tumour of the stomach as a 'carcinoma,' or 'cancer,' more or less qualified by terms which indicate some special physical feature of the growth. Of late years, however, the opinion has been steadily gaining ground that many cases which are regarded as examples of carcinoma are really sarcomatous in character, and at the present time there is sufficient evidence in favour of this view to warrant the inclusion of sarcoma as a special and important variety of malignant disease of the organ. Inasmuch as the duodenum is practically a prolongation of the stomach, the special features of carcinoma of this portion of the digestive canal also demand consideration.

Primary Carcinoma

The neoplasms which belong to this group originate in the epithelial and glandular structures of the organ, and have

been variously described at different times. By the earlier writers they were classified according to their general features as hard and soft cancers, villous and fungoid growths, or cancerous ulcers; while at a somewhat later date certain special varieties were recognised by the terms 'scirrhus,' 'encephaloid,' 'villous,' and 'colloid.' This nomenclature, while it expresses more or less succinctly the naked-eye appearances of the principal forms of the disease, affords but little clue to their morphology, and it has therefore become necessary to classify them according to their histological structure. By means of the microscope three types of primary cancer of the stomach may be recognised. In the first of these the cellular elements are similar in shape and size to the cells which normally line the gastric tubules, and it has consequently received the name of 'glandular' or 'spheroidal-cell' carcinoma. Inasmuch, however, as both the macroscopic and microscopic features of the growth vary according to the amount of fibrous tissue it contains, it is convenient to distinguish a hard variety (scirrhus) from a soft form (medullary). In the second type the tubular and hollow spaces in the matrix are lined by columnar cells like those which exist in the pyloric glands, and to this the term 'cylindrical-celled carcinoma' or 'adenocarcinoma' is applied. Lastly, each variety may undergo myxomatous degeneration, which affects both the cells and fibrous stroma, and transforms the tumour either wholly or in part into a firm gelatinous mass termed 'colloid carcinoma.'

These different varieties are not always sharply distinguished from each other, but are apt to present many gradations and transitional forms. Thus, a soft spheroidal-celled growth may possess a hard fibrous base, or a typical scirrhus may be covered with fungoid outgrowths; while in rarer cases the neoplasm may exhibit a cylindrical-cell formation at one spot and a spheroidal-cell structure at another.

Primary Carcinoma of the Stomach

Spheroidal-cell . { Hard (Scirrhus).
                  { Soft (Medullary or Encephaloid).
Cylindrical-cell (Adenocarcinoma).
Colloid.

1. Scirrhus (Hard Spheroidal-celled Carcinoma).—This variety is chiefly met with in the pyloric region of the stomach

and is characterised by its firm structure and its tendency to contraction.

(*a*) It usually commences immediately inside the orifice, which it often encircles, and thence spreads into the contiguous gastric tissues. The pylorus is thus converted into a rounded or oval mass, the surface of which is smooth or slightly lobulated. When laid open the diseased portion of the viscus presents a conical or funnel shape, while the opening into the duodenum is converted into a long, narrow, and often tortuous channel, which may only admit the passage of a probe.

FIG. 1.—Scirrhous carcinoma of the pylorus causing stenosis. (London Hospital Museum.)

The disease is usually limited to the stomach, and seldom invades the first part of the duodenum; but in the opposite direction it shades off gradually in the gastric wall, and is often prolonged, in the form of bands or rows of small nodules, for some distance along one or both curvatures. Examination of the surface of the section shows that the various coats, though firmly welded together, can still be distinguished from one another. From one-half to two-thirds of the mass consists of submucous tissue which exhibits a smooth white glistening structure, slightly concave at its centre owing to contraction of its fibrous elements, and so hard as to creak under the knife. The contractile tissue of the muscular coat is much hyper-

trophied, and appears as a brownish red or pale pink semi-translucent material, enclosed in small polygonal meshes of a pearly white colour. The walls of these meshes are thickest where they run perpendicularly to the plane of the mucous membrane, and at first correspond to the lines of connective tissue which normally intersect the muscular coat; but as the disease progresses the infiltration becomes more diffuse and the reticulation more complex. The subserous tissue is thickened

FIG. 2.—Scirrhous infiltration of the cardiac and central portions of the stomach, leaving the pyloric end unaffected. (London Hospital Museum.)

and opaque, and the peritoneum itself is usually covered with organised lymph, in which small nodules of new growth may sometimes be detected. The mucous membrane is either congested in patches, or exhibits a uniform dead-white colour, while its surface may be slightly uneven as a result of chronic inflammation, or be covered with small nodules of new growth. In a large proportion of the cases some degree of ulceration is present, the ulcers being small and superficial in character,

with ill-defined sloping edges and bases which are smooth, irregular, papillomatous, or ragged.

(*b*) Occasionally scirrhous carcinoma is strictly limited to the pylorus, where it forms a tumour that may attain the size of a Tangerine orange. The line of demarcation between the healthy and diseased tissues is fairly defined, and with the exception of a slight extension along one or both curvatures the walls of the viscus around the tumour are practically free from infiltration. The greater part of the mass is composed of dense white fibrous tissue, streaked or flaked with yellow; but not infrequently it contains one or two small

FIG. 3.—Scirrhous carcinoma of the pylorus with ulceration. (Museum of the Royal College of Surgeons.)

cysts filled with a grumous fluid, or presents signs of colloid degeneration. As a rule the pyloric orifice is greatly contracted and is converted into a narrow tortuous channel; but when ulceration has taken place the interior of the tumour may present a large sloughing cavity, which communicates freely with both the stomach and the duodenum.

(*c*) In a third variety the disease takes the form of a localised induration of the gastric wall close to the pylorus. The edges of the growth are slightly elevated above the surrounding mucous membrane, while its centre is somewhat depressed. The surface is usually smooth and covered with a brownish mucoid secretion; but occasionally it has a furrowed

or terraced appearance, as though its substance had constantly scaled off. The peritoneal aspect is thickened and often adherent to the liver or pancreas, and on section the whole growth seems to consist entirely of fibrous tissue, which yields a little white juice when scraped. Owing to its proximity to the pylorus, it not infrequently displaces and contracts the orifice, and thus occasions considerable dilatation of the stomach. It will be observed that in its general characters this form of cancer closely resembles the scar of a simple chronic ulcer; and there can be little doubt, as Dittrich originally suggested, that

FIG. 4.—Scirrhous carcinoma forming a localised tumour at the pylorus. Natural size. (London Hospital Museum.)

in the absence of secondary deposits in the liver the malignant nature of the disease is very apt to be overlooked.

(*d*) Scirrhus may invade the whole of the stomach and convert it into a small thick-walled sac, which has been likened to a leather bottle. In a characteristic case the organ is found after death to be retracted beneath the left lobe of the liver, while the space it usually occupies is filled by the transverse colon. When isolated it appears like a piece of thick indiarubber tubing from four to six inches in length, and with a diameter often less than that of the small intestine. The lower end of the œsophagus may be slightly dilated, and the finger can easily be passed

through the cardiac orifice. The pylorus, on the other hand, may be so contracted as barely to admit the tip of the little finger. When the viscus is laid open, its walls are found to be greatly thickened, tough and incollapsible, especially in the pyloric and central portions, the induration, which chiefly affects the submucous and muscular coats, gradually diminishing towards the fundus. Its cavity is represented by a small hollow at either end of the tubular mass, which communicate by a narrow

FIG. 5.—A stomach viewed from behind, showing diffuse infiltration by scirrhous carcinoma, with enlarged glands along the curvatures. (Museum of the Royal College of Surgeons.)

channel, the cubic capacity of the whole varying from half an ounce to three fluid ounces. The inner surface is sometimes quite smooth, and covered with a layer of tenacious mucus; but as a rule one or more small superficial ulcers may be observed about the centre of the organ, while in rare instances the whole of the mucous membrane is extensively ulcerated. The peritoneal investment is much thickened, and there are usually numerous firm adhesions between the diseased organ and the liver,

diaphragm, and colon. Occasionally signs of recent peritonitis are present in the upper segment of the abdomen. In rare instances diffuse scirrhus of the stomach is associated either with stenosis of the cardiac orifice from implication of the lower end of the œsophagus, or with an annular growth at the centre of the organ, which divides it into two small thick-walled pouches, each about the size of a walnut.

FIG. 6.— Cauliflower mass of spheroidal-celled carcinoma situated near the pylorus and extending along the lesser curvature. (London Hospital Museum.)

2. Medullary Carcinoma (Soft Spheroidal-celled Cancer).— This variety of the disease is characterised by an exuberant soft growth, which infiltrates all the coats of the stomach and is usually attended by extensive ulceration. As a rule it commences in the pyloric half of the organ, near the lesser

curvature, where it forms either an irregular flattened tumour, which is slightly raised above the adjacent mucous membrane, or a large cauliflower mass surrounded by several smaller tumours or dendritic growths. The tissue of which it is composed is of soft consistence, dead-white, greyish white, or pale pink in colour, and yields an abundant milky juice when scraped with a knife. Owing to its general resemblance to

FIG. 7.—Soft ulcerating growth of spheroidal-celled carcinoma situated at the cardiac orifice and spreading into the œsophagus. (London Hospital Museum.)

brain substance, this variety of cancer was formerly termed 'encephaloid.'

(*a*) The disease may be strictly circumscribed and occupy a surface several inches square, or it may be elongated and extend for some distance in the long axis of the organ; while occasionally the whole of the inner surface of the stomach is covered with a cauliflower growth, which almost obliterates the cavity and encroaches some distance upon the œsophagus.

After the tumour has attained a certain stage of development it is prone to undergo degenerative changes, which greatly alter its appearance. In most cases interstitial hæmorrhages take place, which give a section a mottled red or yellow colour, and its superficial aspect a brownish-black tint. In other instances the cellular elements are affected by fatty and molecular changes, which produce softening of the tissue and disintegration of the tumour. Both conditions tend to reduce the bulk of the growth and to produce ulceration, so that at a necropsy it is rare to find the fungating mass intact. On

FIG. 8.—Stomach viewed from behind, showing enormous infiltration of its walls with soft spheroidal-celled carcinoma, and its cavity almost obliterated by a cauliflower growth. (London Hospital Museum.)

the contrary, there usually exists a bowl-shaped or crater-like depression in the centre of the tumour, the edges of which are elevated, irregular, and somewhat overhanging; the sides ragged, sloughy, or fungating; while the base varies according as it is formed by tumour substance or by the smooth muscular or peritoneal coat of the stomach. When two or more ulcers are present, they may coalesce and form one deep cavity with a serpiginous overhanging edge.

(*b*) It sometimes happens that the entire growth sloughs away, and merely leaves an ulcerated condition of the mucous

membrane to mark its former site. Such an ulcer usually presents elevated, irregular, and everted edges, and a ragged or papillomatous base; but occasionally it undergoes a further retrograde change, whereby the edges become hard, smooth, and sloping, and the base clean and fibrous in appearance. In this way a soft medullary excrescence ultimately gives place to an ulcer which closely resembles a primary scirrhus, and may even undergo partial cicatrisation. This structural metamorphosis has been described as 'spontaneous healing of cancer;' but the

FIG. 9.—Malignant ulcer of the stomach. (Museum of the Royal College of Surgeons.)

expression is a delusive one, since even in those rare cases where the ulcer heals superficially active growth still continues in the base of the disease, and ultimately leads to secondary deposits in the lymphatic glands and other neighbouring tissues.

(*c*) Medullary carcinoma also occurs in the form of a diffuse infiltration of the walls of the stomach, which may either affect the greater part of the organ or be limited to its pyloric half. In this condition the submucous tissue is greatly thickened,

and the mucous membrane is thrown into firm folds that look like hypertrophied rugæ, or presents numerous thick wheals which run parallel to the long axis of the viscus. Here and there superficial ulcers with ragged walls and fungating bases may be observed, or the surface may be studded with nodules, some of which exhibit deep sloughing cavities. Where the

FIG. 10. — Enormous infiltration of the pyloric half of the stomach by soft spheroidal-cell carcinoma, with ulcerating nodules upon the inner surface. (London Hospital Museum.)

disease is most advanced the muscular coat is also infiltrated and its contractile tissue destroyed; but elsewhere, and especially in the neighbourhood of the fundus, it is often thickened from hypertrophy. The peritoneum is condensed and opaque, and is not infrequently studded with numerous nodules of new growth.

3. Adenocarcinoma (Cylindrical-celled Carcinoma).—This variety may occur in any part of the stomach, but is most common in the pyloric region.

(*a*) It usually presents itself in the form of a soft red fungoid tumour, which springs from a broad base and is sometimes studded with delicate papillæ that give it a distinctly villous character. It usually possesses a firmer consistence than a medullary growth. On section it yields a milky juice, and appears to have grown by spreading itself over the surface of the stomach rather than by infiltrating the deeper layers.

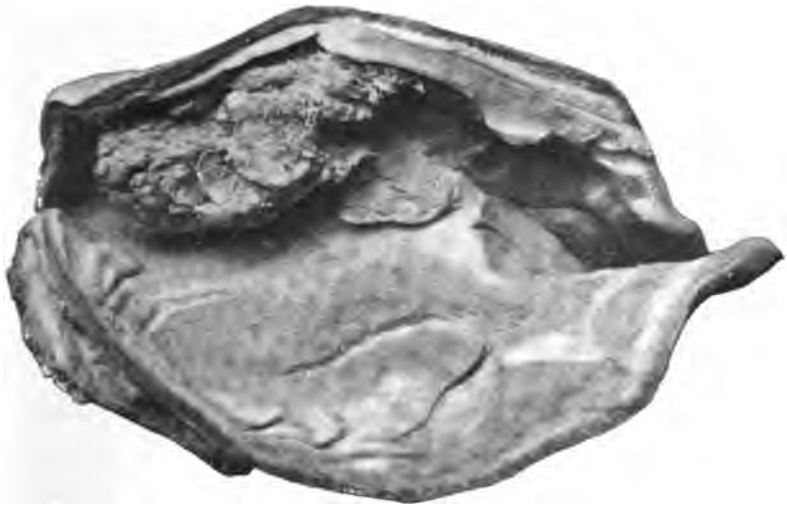


FIG. 11.—Carcinomatous infiltration of the stomach, with a large villous growth projecting from the lesser curvature. Viewed from behind. (Museum of the Royal College of Surgeons.)

Owing to its remarkable vascularity, small hæmorrhages are very prone to occur in its substance and to give the section a variegated red and brown appearance. The more extensive extravasations of blood are usually followed by sloughing of portions of the tumour and the production of deep ulcers, whose cavities are partially filled by fungoid outgrowths. Finally the entire mass may become gangrenous, and being detached may leave an irregular area of ulceration surrounded by a red projecting fungus-like wall. If the necrotic process involves the deeper coats of the stomach, perforation may ensue,

but the aperture is often difficult to detect amid the proliferating tissue which composes the base of the sore.

(*b*) Occasionally the disease forms a girdle round the stomach in the pyloric or central region, in the same manner that it encircles the large intestine. In such cases the only external evidence of the neoplasm may consist of a shallow and opaque

FIG. 12.—An enormous ulcerated fungoid growth of cylinder-celled carcinoma involving the greater part of the stomach and extending into the œsophagus. (Museum of the London Temperance Hospital.)

sulcus, which traverses the viscus at right angles to its long axis; while internally the growth appears as a red fungating ring that divides the stomach into two sacs of unequal size. If the constriction occurs close to the pylorus, the general appearance of the stomach is similar to that met with in stenosis of the orifice (fig. 13).

(*c*) Like the preceding varieties, adenocarcinoma sometimes

occurs as an infiltration of the walls of the organ, which commences near the pylorus and involves the greater portion of the viscus. In this condition the pylorus is usually thickened and rigid, and its orifice patent rather than contracted. The surface of the mucous membrane is uneven or distinctly nodular, and is often superficially ulcerated. When the entire

FIG. 13.—A cylindrical-celled growth at the centre of the stomach, dividing the organ into two sacs. (London Hospital Museum.)

stomach is infiltrated its tissues are greatly thickened, but its cavity is seldom reduced to the same extent as in diffuse scirrhus.

4. Colloid Carcinoma (Mucous or Gum Cancer).—Each variety of carcinoma is liable to undergo a structural metamorphosis, whereby both its epithelial cells and connective tissue are converted into a gelatinous gum-like material termed ' colloid.'

This change may either occur after the growth has already existed for some time, and only partially affect the bulk of the tumour, or it may ensue almost simultaneously with the differentiation of the new elements, so that even the growing edge presents a gelatinous appearance. These facts help to explain the variations that occur in the naked-eye appearances of the disease in different cases.

(*a*) When the original growth has been more or less circumscribed, colloid carcinoma appears as a nodular mass of light

FIG. 14.—Cylinder-celled carcinoma of the pylorus, giving rise to stenosis of the orifice. Viewed from behind. (Museum of the Royal College of Surgeons.)

brown colour and slimy consistence, which projects into the cavity of the stomach. The surface of the tumour is usually ulcerated, and the deeper tissues which are thereby exposed to view exhibit a honeycombed structure, the meshes of which are filled with granules of gelatinous substance. The base of the ulcer may consist of one of the coats of the stomach in a comparatively healthy state, or of hard scirrhous material; while, if the transformation has been more complete, nodules of colloid may be observed beneath the serous coat. In cases of

medullary or adeno-carcinoma, where the greater part of the tumour has sloughed off, leaving an area of ulceration, the colloid change may be recognised by the presence of translucent granules, which project from the walls and everted edges of the ulcer (fig. 15).

(*b*) More commonly colloid takes the form of a diffuse infiltration, which involves the greater part of the stomach, and

FIG. 15.—A malignant ulcer (spheroidal-cell) encircling the pylorus, which has undergone partial colloid degeneration. (London Hospital Museum.)

not infrequently spreads by direct continuity into the duodenum and œsophagus. In this condition the organ is somewhat contracted and its walls greatly thickened. The external surface is profusely studded with nodules, which vary in size from a millet-seed to a cobnut, and is more or less adherent to the large omentum and the surrounding viscera. On section the different coats appear to be replaced by a light-coloured fibrillar network, which encloses a quantity of transparent colourless or brown gelatinous material. The inner surface is

FIG. 16.—A stomach, viewed from behind, showing colloid carcinoma of the pylorus. (Museum of the Royal College of Surgeons.)

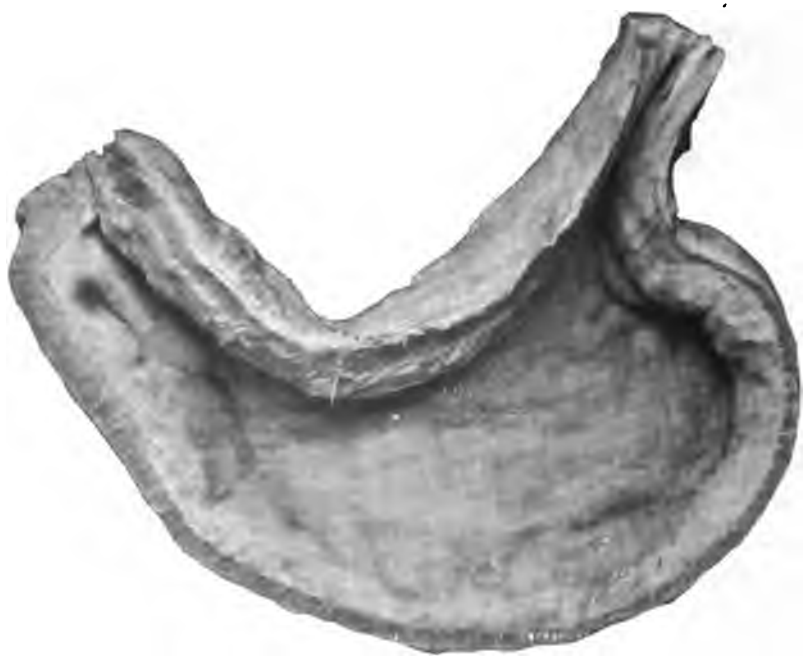


FIG. 17.—Colloid infiltration of the entire stomach. (Museum of the Royal College of Surgeons.)

usually nodular, and is often extensively, though superficially, ulcerated. The extreme fundus sometimes escapes when the rest of the organ is involved.

This diffuse form is very apt to invade the peritoneum, and transform the omentum into an oblong thick mass profusely studded with colloid granules. The gastro-hepatic omentum is affected in a similar manner, and occasionally the disease spreads into the substance of the liver or pancreas. In other cases the general surface of the peritoneum becomes covered with colloid tumours of various sizes, which unite the intestines together, and may even completely fill the abdominal cavity.

FIG. 18.—Colloid carcinoma of the pylorus invading the transverse colon. Specimen viewed from behind. (Museum of the Royal College of Surgeons.)

This form of carcinoma rarely gives rise either to hæmorrhage or to perforation of the stomach.

The relative frequency of the different Carcinomata.—Out of 180 cases collected by Brinton, 130, or 72 per cent., were scirrhus, thirty-two, or 18 per cent., medullary, and seventeen, or 9·4 per cent., colloid; and upon the authority of these figures it has ever since been taught that 'scirrhus is found in three-quarters of the cases of cancer of the stomach.' This statement is not only quite erroneous, but is so obviously based upon insufficient evidence that it seems almost incredible it could have remained unchallenged for such a length of time. In the

Erroneous figures

See next page

first place, it will be observed that the number of cases is far too small to warrant any definite conclusion being drawn from them; while the method of collecting isolated examples from various sources is open to the serious objection that it is only exceptional cases of a disease that are usually deemed worthy of publication. But, in addition to these initial sources of error, the growths themselves were classified solely by their physical characters, the hard varieties being termed 'scirrhus,' and the soft 'medullary,' whereas it is now accepted that not only is it often impossible to determine the nature of the cancer by the naked eye, but even the microscope may fail to differentiate between the two varieties of the spheroidal-celled growth. Finally, Brinton appears to have been unaware of the existence of the cylindrical-celled carcinoma, which, according to Cornil and Ranvier, is the commonest of all; so that we must conclude that the cases of this description which occurred in his series were classified as scirrhus or medullary, according as the disease took the form of an infiltration or of a soft tumour.

The misconception that may arise from a restricted study of statistics is well shown by the fact that out of 1,348 examples of cancer of the stomach which we have collected and analysed according to the method employed by Brinton, 863, or 64 per cent., were described as 'soft,' 'fungoid,' 'medullary,' or 'encephaloid' growths; 447, or 33 per cent., as 'hard' or 'scirrhus,' and thirty-eight, or 2·9 per cent., as 'colloid.' These conclusions, while they agree closely with those arrived at by Welch, are diametrically opposed to the teaching of Brinton.

The only certain method of determining the character of a growth is by submitting it to a microscopical examination; but, unfortunately, comparatively few of the recorded cases have been studied in this way. Perry and Shaw examined forty-four museum specimens of gastric cancer, and found that thirty-two belonged to the spheroidal-cell and twelve to the cylindrical-cell type; while out of 115 cases of our own, seventy-three, or 63·5 per cent., were described as spheroidal-celled, thirty-three, or 28·6 per cent., as cylindrical-celled, and nine, or 7·8 per cent., as exhibiting signs of colloid degeneration. It may also be observed that out of forty-one cases of spheroidal-celled carcinoma, it was especially noted that twenty-two were of the soft or medullary variety, and nineteen of the hard or scirrhous type. These

figures appear to indicate that spheroidal-celled carcinomata are more than twice as common as the cylindrical-celled variety, and that colloid degeneration can frequently be detected by the microscope when invisible to the naked eye.

Situation.—The symptoms of the disease depend so much upon its situation that the question of location is one of considerable importance. All writers are agreed that the pylorus is more often implicated than any other region of the stomach; although whether the growth commences at the valve and spreads inwards, or develops near the orifice and becomes sharply limited by the valve, is a point which is not only impossible to decide, but one that is not endowed with any special value. According to Brinton, 60 per cent. of all gastric cancers are situated at the pylorus; Lebert's estimate was 59·6 per cent., Katzenellenbogen's 58·3 per cent., Luton's 57 per cent., Welch's 60·8 per cent., and Hahn's 36 per cent. In our own series of 265 cases the pylorus was primarily affected in 173, or 65·3 per cent.; while in 1,850 cases which we have collected from different sources, the disease was located in this region in 58 per cent.

TABLE 1.—AN ANALYSIS OF 1,850 CASES OF CARCINOMA OF THE STOMACH, SHOWING THE FREQUENCY OF THE DISEASE IN DIFFERENT REGIONS OF THE ORGAN

Site . . .	Pylorus	Lesser curvature	Cardia	Posterior wall	Great curvature	Anterior wall	Fundus	Whole or greater part	Multiple growths
No. of cases .	1072	214	183	94	52	41	29	111	54
Per cent. .	58	11·5	9·8	5	2·8	2·2	1·5	6	2·9

Next to the pylorus in order of frequency comes the lesser curvature, with the contiguous parts of the two surfaces, which were the seat of the disease in 11·5 per cent. The cardiac orifice, with the tissues immediately around it, was affected in 9·8 per cent., while the fundus, which often escapes when the greater portion of the stomach is involved, was primarily attacked in only 1·5 per cent. The growth was limited to the posterior wall in about 5 per cent., to the anterior surface in 2·2 per cent, and to the great curvature in 2·8 per cent., while the whole or greater part of the viscus was implicated in 6 per cent. The stomach presented two or more separate tumours

in 2·9 per cent. These facts indicate that in 79·4 per cent., or in about four-fifths of all cases, carcinoma commences in the comparatively small strip of tissue which extends from one orifice to the other along the upper margin of the stomach, and that its percentage incidence rapidly diminishes the further we proceed from the pyloric valve.

Relation of the Type of Disease to its Location.—It is usually taught that the orifices of the stomach are most frequently attacked by scirrhus, while the body of the organ is the seat of the medullary and adenomatous forms of carcinoma. This statement, however, is hardly borne out by the results of a microscopical investigation. In forty-two cases of pyloric cancer we find that twenty-nine were described as 'spheroidal-cell,' and thirteen as 'cylindrical-cell.' Of the former, twenty-one presented an excess of fibrous stroma, and may therefore be regarded as 'scirrhus,' while in eight there was a preponderance of the cellular elements, which is characteristic of the medullary variety. It is worthy of notice that the scirrhus was usually limited in extent, and by its contraction had produced stenosis of the pyloric orifice, while the more diffuse infiltration of medullary cancer often gave rise to a rigid patency of the valve. Of the thirteen examples of adeno-carcinoma, six took the form of a diffuse infiltration, five of soft fungating growths, and two of a narrow ring which encircled the stomach about three inches from the pylorus. Owing to the non-contractile nature of the disease, marked stenosis of the orifice was seldom observed. Nineteen cases of cancer of the cardiac orifice were examined, of which sixteen possessed a spheroidal-cell and three a cylindrical-cell structure. Of the former, fourteen exhibited comparatively little stroma, and usually formed soft tumours or deep ulcerations, while in the other two the orifice was greatly narrowed by the contraction of the fibrous elements of the growth (scirrhus). The three examples of adenocarcinoma occurred as soft ulcerating tumours near the lesser curvature, on the inner side of the œsophageal opening. Out of fourteen cases where the posterior wall or lesser curvature was primarily affected, eight were spheroidal-celled and six cylindrical-celled, while an examination of eleven cases of infiltration of the entire stomach showed that nine consisted of spheroidal-celled cancer and only two of the cylindrical-celled type.

TABLE 2

Type	Cases	Pylorus	Curvatures and surfaces	Cardia	General infiltration
Spheroidal-cell.	62	29	8	16	9
Cylinder-cell .	24	13	6	3	2

From these facts several general conclusions may be drawn. (1) Neither of the two fundamental forms of carcinoma exhibits a special predilection for any particular region of the stomach. (2) Circumscribed tumours of the orifices which produce stenosis are usually hard spheroidal-celled (scirrhus). (3) Diffuse infiltrations of the pyloric region or of the greater portion of the viscus, if accompanied by a contraction of the tissues, are usually of the spheroidal-cell type, while those which give rise to rigidity, without marked diminution in the capacity of the organ, are frequently of the cylindrical-cell variety. (4) A ring of new growth, which separates the stomach into two cavities of unequal size, is usually composed of adenocarcinoma, but globular or flattened tumours and malignant ulcerations are most often spheroidal-celled cancers. (5) Adenocarcinoma is comparatively rare as a primary growth near the œsophageal opening.

Multiple Carcinomata.—According to the statistics quoted in the first table, in about 3 per cent. of all cases the stomach exhibits two or more separate growths. The question therefore arises whether they should be regarded as multiple primary cancers, or as examples of primary and secondary growths occurring in the same organ. In about three-fifths of the cases which we have collected the tumours were situated at corresponding spots on the opposed surfaces. Thus, in one instance a malignant ulcer was present on the posterior wall a few inches from the pylorus, and exactly opposite to it there was a fungating mass one inch and a half in diameter, both tumours consisting of spheroidal-celled carcinoma. A similar instance occurred at the cardiac end of the viscus; and Lunn has described a case in which two small medullary tumours situated opposite one another in the pyloric region had caused obstruction to the outlet by their mutual contact. It can usually be observed that one of the tumours is of more recent

formation than the other; and since in all our cases they were identical in structure, there is little difficulty in attributing the formation of the second growth to infection by contact. In a second form of multiple cancers, of which Devic and others have recorded examples, two or more are found upon the same surface of the viscus, but separated from one another by healthy mucous membrane. As a rule they all exhibit the same histological features, and their mode of development can either be traced to erratic lymphatic infection, or be explained by the theory of the transplantation of particles detached from the earlier growth. There yet remain, however, certain cases which hardly admit of explanation by the theory of auto-infection. These are characterised by the simultaneous implication of two portions of the stomach, usually the orifices, by cancerous growths, which may even possess a different structure. Thus, in one of our cases the cardiac orifice was found to be almost entirely occluded by a soft spheroidal-celled growth, while the pyloric region was infiltrated with a cylindrical-celled cancer, and Ripley, Maurizio, and Barth have each described primary cancer of the cardiac and pyloric apertures in the same subject. The fact that two or more organs of the body may become affected by cancer at the same time has long been recognised. Clark and Jackson have recorded instances of contemporaneous disease of the uterus and stomach; V. Winiwarter mentions one in which scirrhus of the breast was associated with a cylindrical epithelioma of the jejunum; and other examples are to be found in the writings of Kauffmann and Beck. Our own series contains two cases of particular interest. In the first a spheroidal-celled cancer of the pylorus coexisted with a cylindrical-celled epithelioma of the rectum, and in the second there were apparently primary growths of different kinds in the bladder, stomach, and sigmoid flexure. While, therefore, it must be conceded that the majority of cases where several growths exist in the stomach may be explained by some theory of auto-infection, there remain a certain number which can only be regarded as examples of multiple primary cancerous tumours.

Secondary Carcinoma of the Stomach

It is commonly stated that secondary cancer of the stomach is extremely rare, and writers formerly accorded considerable

prominence to a case in which Cohnheim discovered a nodule of scirrhus in the stomach after death from a similar affection of the breast. Recent investigations, however, tend to show that the phenomenon in question is by no means so uncommon as is usually believed. Welch was able to collect thirty-seven examples without exhausting the available literature, Ely fourteen, and de Castro twenty-two; while in our own series of 265 necropsies upon cancer of the stomach, nineteen, or 7 per cent., were secondary to disease of some other organ. This latter estimate closely agrees with the conclusions arrived at by Hale White, who states that 6 to 7 per cent. of all gastric carcinomata are of secondary origin.

The relative frequency with which one or other viscus of the body is the site of the primary complaint is found to vary with the method employed in collecting the cases. Thus Welch, who appears to have consulted a great mass of statistics relative to mammary cancer, found that in nearly one-half the gastric complaint was secondary to disease of the breast; while in the statistics of Ely, de Castro, Török, and Wittelshöfer the mouth, œsophagus, uterus, and testicle were more frequently affected.

But when recourse is had to a large series of consecutive necropsies performed at a general hospital, thereby avoiding the errors incidental to an analysis of isolated cases, it at once becomes evident that secondary cancer of the stomach may arise in at least three different ways. Thus, we find that out of the nineteen instances to which reference has been made, no less than fourteen, or 73·6 per cent., were due to direct extension of the disease from some neighbouring organ; that in four, or 21 per cent., the primary complaint was situated in the upper part of the digestive tract; while in only one, or 5 per cent., was the gastric affection of the nature of a true metastasis. These results are of sufficient importance to merit a detailed description.

(1) Invasion of the stomach by contiguity may ensue from cancer of any organ in its immediate vicinity. Out of our fourteen cases, the pancreas was the seat of the disease in six, the transverse colon in three, the lower end of the œsophagus in two, and the gall-bladder, liver, and uterus each in one. Less frequently the peritoneum, retro-peritoneal glands, the adrenals or ovaries are first involved. When the pylorus is invaded, it

often presents a uniform infiltration, as in the primary complaint, with considerable thickening of the serosa; but if the posterior wall of the organ or the fundus is implicated, the growth is comparatively localised, and ulceration of the mucous membrane is by no means infrequent. Cancer of the lower end of the œsophagus seldom spreads far into the stomach, and when it does so, it is usually along the line of the lesser curvature. It is nearly always a squamous-celled epithelioma, but examples of spheroidal-celled growths are more frequent than was once believed. In peritoneal cancer the stomach is invaded from without by numerous nodules, which form projections beneath the mucous membrane, and may even produce typical ulceration. In one of our cases cancer of the uterus spread by way of the great omentum into the pylorus, which became greatly contracted and proved the immediate cause of death.

FIG. 19.—Squamous epithelioma of œsophagus with a secondary growth in the stomach. (Museum of the Royal College of Surgeons.)

(2) The undue frequency with which the stomach is affected in cancer of the tongue, mouth, nares, and œsophagus is probably due, as Klebs suggested, to the detachment of particles of growth, which are swallowed, and subsequently

become engrafted upon the gastric mucous membrane. In one case of this kind which came under our notice an ulcerated stricture of the œsophagus was found opposite the cricoid cartilage, and another and apparently more recent growth three inches lower down; while at the inner side of the cardiac orifice, upon the posterior wall of the stomach, was a flattened ulcerated tumour which, like the œsophageal growths, was composed of flat-celled epithelioma. In another instance, where the primary disease occurred about three inches above the cardiac orifice, a large fungating tumour occupied the middle of the lesser curvature. Both growths consisted of spheroidal-celled carcinoma. As a rule the gastric tumour is solitary, and grows in the cardiac region of the viscus, near its upper border. Ulceration is infrequent.

(3) Secondary deposits in the stomach from a growth in an organ remotely situated probably arise from infection of the blood-stream, and are usually associated with metastases in the liver or lungs. Out of thirty-one cases of this description which we collected, the breast was primarily affected in twenty, the right testicle in two, the uterus in three, the bowel in two, the skin in two, and the kidney and adrenals each in one. The tumour in the stomach was usually solitary, of variable size, situated in the submucous tissue, and rarely accompanied by ulceration.

Histology

It is difficult to trace the evolution of carcinoma in the stomach, owing to the extensive destruction of the tissues which occurs at an early period of the disease, and the changes that take place in the mucous membrane immediately after death. Most of our knowledge of this subject has been derived from the observations of Hauser upon the development of cancer in the base of a simple ulcer.

Although the different forms of growth vary considerably, both in their macroscopic appearances and histological structure, they nevertheless possess certain features that are common to all, and which serve to distinguish them from other tumours of the organ, both malignant and benign.

The earliest signs of a departure from the normal consist of an active proliferation of the epithelium of a small group of glands, which leads to distension of the tubules with cells of various shapes and sizes, obliteration of their lumina, and a

marked alteration of their outlines. At the same time the capillaries which ramify in the deeper portions of the mucous membrane become engorged with blood, and exudation of leucocytes takes place, accompanied by proliferation of the corpuscles of the connective tissue and enlargement of the solitary lymphatic follicles. Many of the newly formed cells exhibit particles of brownish black pigment, and the oxyntic cells of the neighbouring glands are often affected in a similar manner. The epithelial overgrowth soon gives rise to elongation, twisting, and distortion of the tubules, which causes them to appear branched or racemose; while the ducts become choked with *débris* and their columnar cells filled with mucus. Up to this period the morbid process closely resembles an adenoma; but it now displays its malignant character by the rupture of the basement membranes of the affected glands and escape of the epithelium, which continues to penetrate the surrounding connective tissue in the form of branching columns similar in appearance to the peptic glands, but devoid of a membrana propria. This extension chiefly takes place through the lymphatic spaces; but many of the cells become detached, and wander in an amœboid manner through the tissues, where they produce new foci of disease at a considerable distance from its primary seat. Within a short time the muscularis mucosæ becomes involved, and its fibres are separated and compressed by an invasion of the intermuscular lymphatic channels. After reaching the submucosa the columns of cells continue to invade the lymph-spaces in all directions, while the connective-tissue elements actively proliferate, and, being reinforced by an inflammatory exudation of small round cells, become converted into a fibrous reticulum or stroma, the amount of which is usually in inverse proportion to the number of cells. When the latter are in excess, the meshes or alveoli of the stroma are of considerable size and closely set; but when the fibrous tissue predominates the spaces are usually small and scanty, and may only appear as fissures containing irregular groups or rows of cells. The epithelium itself varies considerably in character, in some cases consisting of quadrilateral cells arranged in layers, the deepest of which may be distinctly columnar, while in others the alveoli are stuffed with cells, whose mutual pressure causes them to appear round, ovoid, or polyhedral. Each cell contains one or more nuclei, which often exhibit

atypical mitoses, and occasionally the cell-enclosures or 'parasites' described by Soudakewitsch and Ruffer may be detected in them. Multiplication takes place both by budding and by karyokinesis. The smaller vessels of the submucosa are also affected by a round-cell infiltration of their outer coats and a hyperplasia of their intima, while, according to Cornil and Ranvier, they often present minute aneurysmal dilatations. These changes are apt to result in the formation of thrombi in the veins, with subsequent invasion of the clot by the epithelial cells which have penetrated the vascular wall. Although the loose structure of the submucous coat of the stomach offers every facility to the spread of the disease by continuity, the marked preference exhibited to lymphatic invasion leads to an early dissemination of the cells through the surrounding tissues, and especially in the direction of the serosa. At first thin rows of cells are observed in the intermuscular septa, where they provoke an inflammatory thickening of the connective tissue and induce compensatory hypertrophy of the muscular fibres. Thence they extend towards the peritoneum, and either form a thick layer beneath the serous membrane or numerous isolated groups in the lymphatic vessels. Subsequently cells appear between the individual fibres of the muscular coat, while the ever-increasing infiltration of the septa compresses the contractile tissue and eventually leads to its fatty degeneration and atrophy.

The abnormal stimulation of the tissues excited by the epithelial invasion results in the formation of new blood-vessels by a process of budding from the pre-existing vascular channels. This increased vascularisation exerts an important influence upon the subsequent course of the disease, for although at first it is conducive to rapid growth, the newly formed vessels are very apt to rupture and to give rise to hæmorrhagic infiltration and sloughing of the tumour. In every instance, also, the gradual obliteration of the original vessels due to their compression or thrombosis diminishes the nutrition of the growth, and leads to degeneration of its substance. So remarkable, indeed, is this tendency to retrogressive metamorphosis that it may be said that carcinomatous tissue is characterised from the outset by degeneration. In most cases fatty changes develop first in the cells situated in the centres of the alveoli; but in others the stroma is converted into colloid material, and the

cells subsequently undergo myxomatous degeneration. These latter changes are most frequently encountered in the cylindrical-celled variety of the disease. At first the mucous membrane around the growth is affected by a chronic form of inflammation, which produces considerable thickening of the interglandular connective tissue and is accompanied by catarrhal changes in the peptic cells. The contraction of this newly formed tissue compresses and distorts the glands, and often gives rise to small retention cysts. In the case of a slow-growing hard carcinoma, this gastritis may proceed to atrophy of the secretory structures before they are actually invaded by the

FIG. 20.—Scirrhous carcinoma of the stomach (× 100).

disease ; but in the softer forms the atypical epithelium soon penetrates both the tubules and the tissue that separates them, and completely destroys the mucous membrane at a comparatively early period.

Scirrhous carcinoma is characterised by the presence of an excess of stroma and a marked deficiency of the cellular elements. All the coats of the stomach are much thickened, and the submucosa consists almost entirely of greyish-white coarse, fibrillated cicatricial tissue, which here and there may exhibit a small hollow or fissure containing a few epithelial cells. The muscular layer is much hypertrophied, and its fibres are enclosed in a meshwork of fibrous tissue produced

by thickening of the intermuscular septa. There is also a notable induration of the subserous connective tissue, while

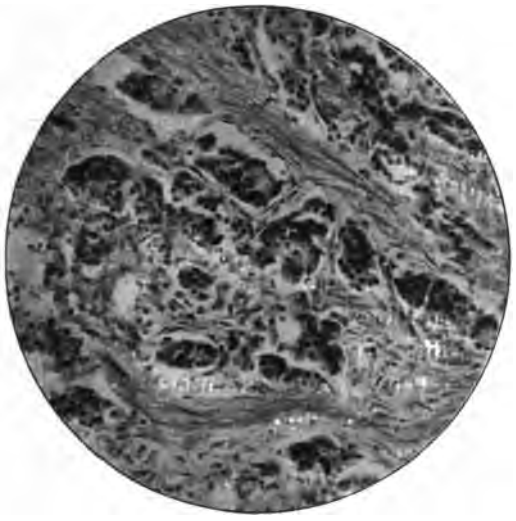


FIG. 21.—Scirrhous carcinoma of the stomach (× 430).

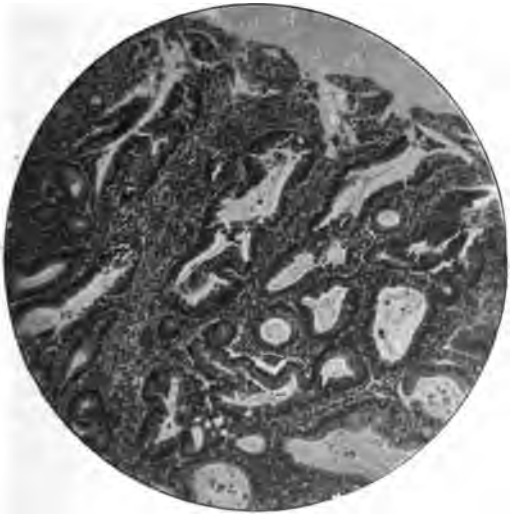


FIG. 22.—Cylinder-celled carcinoma of the stomach (× 100).

the mucous membrane shows signs of chronic interstitial gastritis.

Medullary carcinoma differs from the preceding in the excessive number of cells it contains and the relative deficiency of stroma. The alveoli are large and numerous, and filled with cells of a round or oval shape. Infection of the deeper tissues occurs through the lymphatic vessels, and rows of cells may be observed in the intermuscular septa and immediately beneath the serous membrane even before the growth in the submucosa has made any substantial progress. The mucous membrane is also invaded and destroyed at a comparatively early period.

Cylindrical-celled carcinoma.—In this variety the alveoli are large and of various sizes and shapes, and are supported by a delicate stroma rich in blood-vessels. By mutual compression the cells assume different forms, and it may only be the deepest layer that presents the typical columnar shape, while it is often impossible to distinguish some parts of the section from the spheroidal-celled variety. Colloid degeneration is more frequent in this form than in the others (fig. 22).

Colloid carcinoma presents a fine meshwork of connective tissue, which encloses a large quantity of clear muco-colloid material. No cellular elements may exist, or here and there a few cells or fragments may be detected. At the margin of the tumour the usual appearances of carcinoma are to be found; and the process of degeneration may be traced in the development of clear globules in the substance of the cells, which gradually coalesce and destroy the regularity of their outline.

CHAPTER II

THE SEQUELÆ OF CARCINOMA

1. Adhesions

THE formation of adhesions around the seat of the disease is of considerable importance both as regards diagnosis and also surgical treatment. The adhesions themselves vary considerably in different cases, in some being of recent formation and so soft that they are easily broken down by the finger, while in others the abdominal viscera are so firmly matted together that it is impossible to separate one organ from another. In one form or another they exist in the vast majority of the cases in which the disease has run its usual course, but the frequency with which the more important variety is met with has been variously estimated by different writers. Debelut found well-marked adhesions in one-half of the cases he collected, and Osler in about 56 per cent. of those which came under his observation. Gussenbauer and V. Winiwarter noted their existence in 370 out of 542 cases of pyloric cancer (68 per cent.), while, in 300 cases in which laparotomy was undertaken for the relief of the disease, Guinard states that the pylorus was only perfectly movable in fourteen, or about 5 per cent. In our own series of 265 fatal cases, adhesions were sufficiently numerous to attract the attention of the pathologist in 213 instances, or in 80 per cent. It may therefore be accepted that in about four-fifths of all cases the affected region of the stomach is adherent to some neighbouring organ at the time of death.

The situation of the growth exerts a certain amount of influence upon the formation of adhesions. This is shown in the following table.

TABLE 3

Situation of growth	No. of cases	Adhesions present	Percentage
Pylorus	173	139	80·3
Cardia	24	18	75·0
Lesser curvature	29	26	89·6
Posterior wall	13	12	92·3
Greater curvature	6	5	83·3
General infiltration	20	13	65·0
	265	213	—

In order that plastic perigastritis should be set up it is necessary that either the neoplasm itself or its toxic products should gain entrance to the subserous lymphatics, and it is consequently found that adhesions are most frequent and extensive in those cases in which the disease has infiltrated the whole thickness of the gastric wall or has undergone ulceration. Both conditions are best exemplified in the soft spheroidal-celled cancers, which rapidly penetrate the muscular coat and produce deep ulcers. The cylindrical-celled variety, although at first chiefly confined to the submucous tissue, is apt to slough, and is therefore rarely unaccompanied by adhesions after the lapse of a few months. A localised scirrhus of the pylorus, on the other hand, often grows very slowly, and not infrequently gives rise to fatal vomiting without having excited sufficient inflammation of the peritoneum to fix the part to a neighbouring viscus.

Disease of the pylorus and the lesser curvature usually gives rise to adhesions with the under surface of the right lobe of the liver, while a growth of the cardia either involves the same organ or the pancreas. When the posterior wall is the seat of ulceration, the pancreas is almost always affected, and in many instances the stomach also becomes united to the vertebral column. A neoplasm of the great curvature is particularly apt to invade the transverse colon, and in those rare cases in which the fundus is primarily affected the spleen often becomes attached to the base of the disease. It is comparatively rare for only one organ to be involved in adhesions, since the inflammation of the peritoneum soon spreads to the other abdominal viscera. In our series of cases two or more organs were firmly united in about 70 per cent. of those in which adhesions occurred; while in about 10 per cent. all the viscera were so matted

together that it was impossible to separate one organ from another.

TABLE 4.

Organs adherent	Cancer of pylorus	Cancer of cardia	Cancer of lesser curvature or posterior wall
Liver only	23%	9%	11%
Colon only	5%	—	—
Pancreas only	6%	16%	19%
Uterus only	1·5%	—	—
Abdominal wall	1·5%	—	2·6%
Two or more organs	63%	75%	67·4%
	100%	100%	100%

Effects of Adhesions.—The development of perigastritis is an important factor in the spread of carcinoma, since the morbid growth rapidly infiltrates the newly formed connective tissue, and thus extends by direct continuity into the wall of the attached structure. In this manner fresh foci are constantly forming at the base of the disease and infecting new systems of blood-vessels and lymphatics. If the intestine happens to be involved, the neoplasm either compresses its lumen and occasions symptoms of obstruction, or it gradually destroys its coats, with the ultimate production of a fistula. Finally, implication of the lymphatic vessels of the peritoneum may lead to general carcinoma of that serous membrane and of the pleuræ, or, should the receptaculum chyli be attacked, the *materies morbi* may gain an entrance to the general circulation.

Fixation of the stomach to an organ in its vicinity tends to trammel its movements and so to increase its tendency to dilatation. This result is especially noticeable in cases of adhesion between the pylorus and the liver, since the weight of the viscus dragging upon its fixed point produces a kink, which greatly hinders the propulsion of the chyme into the intestine; indeed, this form of obstruction is responsible in great measure for the gastric dilatation that usually accompanies non-stenosing carcinoma of the pylorus or first part of the duodenum. Similarly, the contraction of adhesions between the cardiac end of the stomach and the liver or pancreas often twists and obstructs the lower end of the œsophagus; while universal adhesion of the abdominal viscera may compress the stomach and greatly reduce its cubic capacity. In not a few

cases the formation of adhesions is also responsible for certain difficulties of diagnosis. Thus, it is not uncommon for the pylorus to be drawn up beneath the liver so as to obscure the existence of a tumour, and for compression of the bile duct or portal vein to occasion early jaundice or ascites, and in this way to distract attention from the primary complaint. On the other hand, peritoneal adhesions perform the useful part of limiting the diffusion of the gastric contents in cases of perforation, and thereby of preventing general peritonitis.

2. Changes in the Shape of the Stomach

Carcinoma is almost always accompanied by some alteration in the shape of the stomach. In most cases this takes the form of an increase of size, but occasionally the viscus becomes greatly thickened and contracted, or presents some less regular deformity.

It is usually stated that disease of the pylorus is always accompanied by gastric dilatation, owing to the retention and decomposition of the food which ensue from obstruction of the orifice. This, however, is hardly accurate, since many cases of pyloric cancer are associated with contraction rather than dilatation of the stomach, while gastric enlargement may exist without any stenosis of the outlet. Thus, Lebert found that out of twenty cases in which the pylorus was obstructed the stomach was dilated in thirteen and contracted in seven; and out of nine instances where the orifices were free from disease the organ was dilated in four and contracted in five. Our own series includes ninety-eight cases of pyloric disease in which special mention is made of the size of the stomach after death; of these the organ was described as 'much dilated' in forty-one, 'dilated' in eleven, 'normal' in ten, and 'contracted' in thirty-six.

It is therefore obvious that the stomach varies considerably in size in different cases, even when affected by the same lesion, and that the factor which determines its ultimate condition may often be independent of the original disease.

A. DILATATION

In its most pronounced form a dilated stomach appears to occupy the greater part of the abdominal cavity, and in such

cases the pylorus is almost always found to be the seat of a localised scirrhous growth which has reduced the outlet to a narrow channel. The disease is often, but not invariably, adherent to the under surface of the liver, and the walls of the viscus are peculiarly thin and transparent. The clinical history indicates that for the first five or six months the gradual contraction of the pylorus was accompanied by a compensatory hypertrophy of the muscular wall of the stomach, the forcible contractions of which were plainly visible through the abdominal parietes. As soon, however, as the general nutrition became seriously impaired the contractile power rapidly failed, and the signs of atony and dilatation made their appearance.

A moderate degree of gastrectasis often accompanies those varieties of carcinoma which produce a rigid patency of the pylorus. In such it may usually be observed that the dilatation is confined to the central and cardiac portions of the organ, and that in addition to the increase of cubic capacity the muscular coat is considerably hypertrophied. This latter condition points to the existence during life of some obstruction to the passage of food into the intestine, and since no obvious obstruction is apparent after death, it must have arisen from destruction of the muscular tissue of the pyloric segment by the new growth. A parallel to this is to be found in the dilated and hypertrophied state of the lower œsophagus which ensues from paralysis of the cardiac sphincter.

In addition to these two main factors in the production of gastric dilatation, viz. stenosis and paralysis of the pylorus, there are probably several others which aid the process in an adventitious manner. In the first place, every case of carcinoma is accompanied by a diffuse chronic gastritis. As a rule the inflammatory mischief merely affects the mucous membrane; but if the pylorus is contracted or the growth has undergone extensive ulceration, it often spreads to the muscular tunic and impairs the contractile power of the tissue. Secondly, the incompetency of the pyloric valve which results from its infiltration by a soft growth must permit of the constant regurgitation of fluids and gas from the duodenum, which not only distend the stomach, but continually stimulate its secretory and motorial apparatus, and thus induce fatigue. Lastly, adhesions between the stomach and neighbouring viscera not only trammel the

gastric movements, but are apt to twist the pylorus or upper part of the duodenum and thus to produce a severe form of mechanical obstruction.

B. CONTRACTION

The most noticeable examples of contraction of the stomach are met with in cases of diffuse scirrhous infiltration, when the viscus is converted into a thick tube, from four to six inches in length, and closely resembles a piece of small intestine. Owing to the dense infiltration of the submucosa the lumen of the organ is so much reduced that it may only admit a catheter of medium size, while its cubic capacity may not exceed one fluid ounce. A considerable degree of contraction also arises from general infiltration by medullary or adeno-carcinoma, but as a rule the shape of the organ is better preserved and its cavity is less diminished.

Diminution in the size of the stomach without direct implication of its walls is a frequent result of non-retention of food. Almost every case of stricture of the cardiac orifice is associated with a contracted stomach; and if the ingestion of food has been suspended for some time the organ may be retracted beneath the ribs, and reduced to the size and shape of an orange. In like manner, certain cases of pyloric stenosis are found to be accompanied by a contracted rather than a dilated stomach, owing to the excessive vomiting which had existed during the last few weeks of life having maintained the organ in a state of depletion. Lastly, secondary carcinoma of the peritoneum often produces such dense adhesions between the various abdominal viscera that the stomach is compressed and its cavity almost obliterated.

C. IRREGULAR DEFORMITY

A growth situated between the orifices may produce considerable alteration in the shape of the stomach. The most frequent deformity from this cause is the partial division of the organ into two sacs (hour-glass contraction). As a rule the disease is of the cylinder-celled variety, and forms a narrow ring round the pyloric segment about three inches from the orifice. As a result of the partial obstruction which is thus produced, the cardiac sac becomes considerably dilated and its muscular coat hypertrophied, while the pyloric portion is either

normal in appearance or is more or less invaded by the growth. In other cases a scirrhus of the cardia spreads round the organ at the junction of the fundus with the central portion, and thus divides it into a large thin-walled pyloric sac and a small hypertrophied pouch situated immediately beneath the lower end of the œsophagus. Less frequently the constriction occurs in the centre of the stomach, and should the amount of infiltration be excessive, the organ may present the appearance of a dumb-bell. This rare condition is well shown in fig. 13, p. 15,

FIG. 23.—Scirrhous carcinoma of the cardiac orifice with hour-glass stomach. (Museum of the Royal College of Surgeons.)

where the channel of communication between the cardiac and pyloric pouches measured one inch and a half in length, and barely admitted a small lead pencil.

The other varieties of deformity hardly require a detailed description. A contracting growth of the lesser curvature tends to approximate the two orifices, with consequent kinking of the duodenum; while an irregular extension of the disease may either divide the viscus into three or four sacs, bend it upon itself, or, by contracting adhesions with the uterus, drag it into a vertical position.

3. Ulceration

According to Lebert ulceration is met with in three-fifths of all cancers of the stomach; and with this statement our own observations closely coincide, since we find that it was present in 64·5 per cent. of our cases. It occurs most frequently among the soft medullary growths, but it is also common in the fungating forms of adenocarcinoma and in localised scirrhus, though it is rare in colloid. The ulcer itself varies considerably in appearance in different cases. In the soft exuberant growths it usually takes the form of a deep crater-like excavation, the edges of which are thickened, irregular, and overhanging, the walls shaggy, and the base studded with villous or fungoid processes. When the tissues of the stomach are affected with a diffuse form of infiltration, the inner surface often presents several discrete ulcers, which are somewhat oval in shape, with their long axes parallel to the great curvature. Occasionally they are quite superficial, and resemble simple abrasions of the mucous membrane; but as a rule the edges are slightly thickened and everted, while the base, which is situated in the submucous or muscular coat, is hummocky or terraced, and covered with fine papillæ or with loops of blood-vessels. In colloid carcinoma the ulcer is usually superficial, and has a characteristic reticulated appearance.

Although carcinoma is most frequent in the pyloric region, the tendency to ulceration appears to be greatest when the growth occupies the walls of the viscus in the vicinity of the curvatures.

TABLE 5

Situation . .	Pylorus	Walls and curvatures	Cardia	General infiltration
Ulceration .	46%	68%	52%	46%

This is probably due rather to the type of the disease than to any influence of locality, since growths of the central regions of the viscus are usually of the medullary or villous type, which are particularly prone to ulcerate.

The size of the ulcer varies considerably; in some cases it hardly exceeds the dimensions of a split pea or a hemp-seed, while in others tracts of tissue several inches square may be

involved, or almost the whole of the inner surface of the organ may be affected (fig. 12, p. 14). The depth of the ulcer varies in different cases. In the scirrhous and colloid forms of the disease it is comparatively superficial and rarely extends beyond the submucous coat, while in the softer growths more or less destruction of the muscular layer is met with in nearly 40 per cent., while exposure of the peritoneum occurs in about one-quarter (27 per cent.) of the cases.

The different features which are thus presented by a cancerous ulcer depend to a great extent upon its mode of formation. In scirrhus the solution of continuity often owes its origin to stretching of the mucous membrane by the subjacent growth, and to its partial deprivation of arterial blood by the pressure exerted upon its nutrient vessels. The gradual devitalisation which is thus induced renders the tissue unable to withstand the solvent action of the gastric juice, which consequently gives rise to superficial erosion. In other cases the mucous membrane is itself invaded by the disease, and undergoes a gradual necrosis as the result of the retrograde changes that occur in the new tissue.

The extensive ulceration which so often attacks the softer varieties of tumour is caused either by softening and disintegration of the growth, or by gangrene arising from thrombosis of a nutrient artery. In the former case the process is a gradual one, and while the central portion of the tumour is destroyed, rapid proliferation takes place in the surrounding parts. In the latter, large masses are apt to slough off, with imminent danger to the integrity of the gastric wall and to the large blood-vessels that supply it.

Simple ulceration of an acute character occasionally occurs along with carcinoma. As a rule it develops in the immediate vicinity of the disease, and owes its origin to an extension of the arterial thrombosis to which reference has just been made. In other cases the ulcer appears at some distance from the growth, either near the cardiac orifice or in the first part of the duodenum. In such it is usually found that the patient had suffered from the symptoms of septicæmia for several weeks before death, and occasionally the mitral valve shows signs of recent endocarditis. It is probable, therefore, that the disease originated in septic embolism, as in ordinary cases of pyæmia. In one of our cases of gastric cancer which succumbed to fatal hæmorrhage the

coronary artery was found to have been eroded by a small simple ulcer on the lesser curvature; while in another fatal peritonitis ensued from the perforation of an acute ulcer of the duodenum. On the other hand, a chronic simple ulcer, if it precedes the carcinoma, is apt to be invaded by the malignant disease; while the so-called 'simple ulcer,' which occasionally develops opposite the growth, is always found on microscopical examination to possess a cancerous structure.

4. Hæmorrhage

Extravasation of blood into the stomach is a frequent result of malignant disease. In the majority of the cases it is very slight, and merely imparts a brownish or black tinge to the gastric contents; but occasionally the patient vomits a considerable quantity of florid blood, while in rare instances the hæmorrhage is so profuse as to destroy life. It is therefore convenient to distinguish three varieties, namely, the slight, the moderate, and the excessive.

(1) *Slight hæmorrhage* probably occurs in every case at some period of its course, and in many it may be said to be almost continuous. It is met with in all forms of the disease, but is most frequent in growths of the pylorus and of the lesser curvature. The blood does not appear to be derived from any particular part of the growth, but oozes from its general surface and from the congested mucous membrane around it. As a rule the bleeding originates spontaneously, and is particularly apt to occur during the period of digestion, when the determination of blood to the stomach is greatly augmented. It is probable, however, that direct irritation of the vascular growth by particles of food is not infrequently an exciting cause, as it is exceptionally common when the patient indulges in a mixed diet, and is very prone to follow exploration of the stomach with a tube. In other cases it ensues from local embarrassment of the circulation consequent upon the thrombosis of a small vessel; while occasionally it is due to the rupture of one of the varicose veins which ramify around the base of the disease.

(2) *Moderate hæmorrhage* was estimated by Brinton to occur in 7 per cent. and by Lebert in 12·5 per cent. of all gastric cancers. In our own series of 150 clinical cases

moderate hæmatemesis was recorded in sixteen instances, or in 10·8 per cent. It may therefore be concluded that an attack of bleeding similar in character to that which ensues from a simple ulcer occurs in 10 to 12 per cent. of all cases of carcinoma of the stomach. The liability to this form of hæmorrhage is greatest when the disease affects one of the orifices, though it is by no means infrequent in growths of the body of the viscus; and its occurrence is an almost certain indication that ulceration has taken place.

The vessels usually eroded are the submucous and subserous branches of the superior pyloric or coronary arteries; but

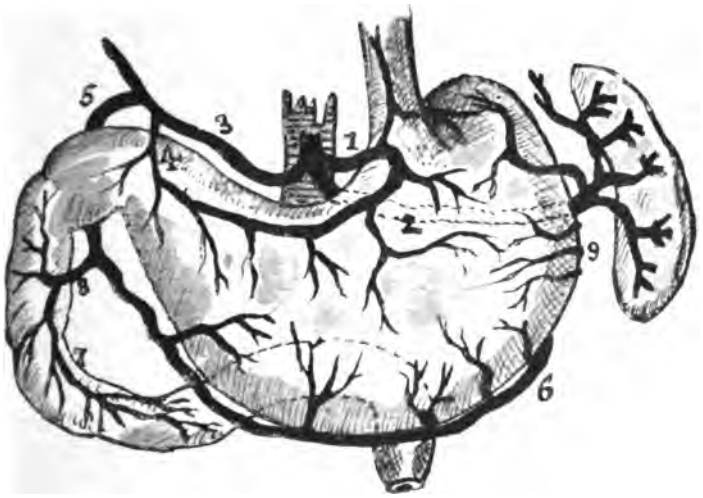


FIG. 24.—Diagram of the stomach and duodenum, showing their arterial blood-supply. 1, coronary artery; 2, splenic; 3, hepatic; 4, pyloric; 5, gastro-duodenal; 6, right gastro-epiploic; 7, 8, superior pancreatico-duodenal; 9, left gastro-epiploic.

occasionally sudden sloughing of a portion of the growth will simultaneously destroy several of its small nutrient vessels. It is important to note that severe hæmorrhage is rarely observed in disease of the pylorus which has given rise to marked stenosis. This phenomenon may be explained partly by the fact that a contracting cancer of the pylorus is usually scirrhus, and consequently less liable to undergo extensive ulceration than the other varieties, and partly by the comparative anæmia of the gastric walls that results from the long-continued stretching and dilatation of the organ.

(3) *Excessive hæmorrhage*, leading to a rapidly fatal termination, is extremely rare. Brinton found only four examples among the 374 cases of cancer of the stomach he collected (about 1 per cent.), and our own series of autopsies upon the disease only contains two cases (0·75 per cent.) in which death resulted immediately from loss of blood. The accident usually arises from the sloughing of a soft growth situated upon the posterior wall or lesser curvature. In fifteen cases where exact details are given we find that the coronary artery was the source of the hæmorrhage in eight, the superior pyloric artery in four, the splenic artery in two, and the right gastro-epiploic artery in one. In rare instances the morbid growth may destroy a large vessel in some neighbouring organ, such as the liver, pancreas, or spleen, or it may erode the aorta, vena cava, or the portal vein (Cassimir-Broussais). Considering the widespread destruction wrought by a cancerous growth, it seems at first sight somewhat strange that severe hæmorrhage is so infrequent, while in a simple gastric ulcer hæmatemesis occurs in about 71 per cent. of the cases and is the immediate cause of death in 18 per cent. of the fatal cases. A consideration of the pathology of the two diseases, however, at once explains this apparent anomaly. Simple ulcer is a strictly local affection, and the tissues which surround the area of necrosis remain in a comparatively healthy state, so that when a large vessel is involved by the disease the erosion of its wall is followed by severe hæmorrhage. A cancerous growth, on the other hand, not only destroys the smaller vessels which lie in its course, but by invading the walls of the arteries gives rise to thrombosis of their contained blood. It consequently happens that the arterioles exposed by the ulcerative process are already obliterated; indeed, it is only in cases of rapid and extensive sloughing that the destruction of tissue extends beyond the area of protection.

5. Perforation of the Stomach

Perforation of the coats of the stomach is a frequent result of a cancerous growth, but its effects vary considerably under different conditions. If no adhesions have previously formed around the base of the disease, the contents of the viscus will find their way into the general cavity of the peritoneum and set up a diffuse suppurative inflammation. On the other hand,

if adhesions are present, the inflammation may be strictly circumscribed, and a localised abscess will develop instead of general peritonitis. Lastly, should the base of the disease be adherent to some neighbouring organ, like the liver, pancreas, or colon, the result will be an infiltration and destruction of the tissues of the viscus secondarily affected, with perhaps the production of a gangrenous cavity in its substance or the establishment of a fistula.

A. ACUTE GENERAL PERITONITIS

This result of perforation is a comparatively rare cause of death in cancer of the stomach. Brinton noted its occurrence only in seventeen out of 507 cases, or in 3·3 per cent.; Lange in twelve out of 290 cases, or 5·7 per cent.; while in our own series of 265 cases it was observed six times, or in 2·3 per cent. It would thus appear that out of a total of 1,062 cases fatal perforation occurred in thirty-five, or about 3 per cent. The usual site of the lesion is the pyloric end of the organ, near the lesser curvature and on the posterior surface. It is most frequent in medullary carcinoma and in soft growths of the cylinder-celled variety, since both penetrate deeply into the gastric tissues and are prone to undergo rapid ulceration. In scirrhus complete perforation is rarely observed, while in diffuse colloid it is almost unknown (Ellett). The actual perforation is usually inconspicuous, and often resembles a small ragged fissure, but occasionally it appears as an oval or circular hole with gangrenous edges and of considerable size. Ulceration of a large area of the stomach may lead to perforation of its coats at several places. In such cases it is usually found that only one ulcer has communicated directly with the general cavity of the peritoneum; but Zuccarelli has recorded an instance in which several perforations occurred simultaneously.

B. PERIGASTRIC ABSCESS

A localised abscess may occur under three conditions: (1) If adhesions have previously formed around the base of the disease in such a manner as to prevent extravasation of the gastric contents into the general cavity of the peritoneum; (2) if the initial leakage is so slight as to cause a strictly localised peritonitis, which in its turn helps to circumscribe the products of inflammation; (3) if the perforation occurs in localities which are outside the peritoneum, as, for instance, between

the layers of the lesser omentum, in the lesser cavity of the peritoneum, the orifice of which (foramen of Winslow) has been previously obliterated, or in the substance of some solid organ in the neighbourhood.

Frequency.—About 10 per cent. of all cases of perigastric abscess arise from malignant disease of the stomach or duodenum; but its exact frequency in gastric cancer is difficult to determine, since the majority of writers merely refer to the fact of its occurrence without offering any statistical evidence. Brinton found that an intraperitoneal abscess was present in four out of 507 cases (0·8 per cent.), and a similar condi-

FIG. 25.—A medullary growth which had sloughed and produced perforation of the stomach. (Museum of the Royal College of Surgeons.)

tion was observed eight times in our own series of 265 autopsies, or in 3 per cent. On the other hand, Osler and McCrae noted its existence in three out of their forty-six cases. It probably occurs in 3 to 5 per cent. of all cases of gastric carcinoma.

Position and Boundaries.—The formation of an abscess is a late phenomenon in gastric cancer. It usually arises in connection with a growth which has destroyed the posterior wall of the viscus near its upper margin, and its sac is then formed by adhesions between the under surface of the liver and the stomach. Less frequently perforation takes place into the lesser cavity of the peritoneum, and the resulting abscess is bounded in front

by the stomach, behind by the pancreas, above by the liver, and below by the colon and transverse mesocolon. In such cases the pus may find its way into the duodenum or the colon, or make its way upwards towards the surface of the liver. Next in order of frequency is the formation of an abscess between the lower border of the stomach and the transverse colon, as a result of a growth of the great curvature. In this condition the area of suppuration is strictly limited by adhesions between the two organs, and the sac often discharges its contents into the large bowel. When perforation of the anterior wall of the stomach gives rise to an abscess, the latter is bounded in front by the abdominal parietes; behind by the stomach, the small omentum, and perhaps the colon; above by the liver; and below by adhesions between the intestines and the wall of the abdomen. In these cases the pus exhibits a tendency to follow the course of the round ligament, and not infrequently points at the umbilicus; less commonly it tracks along the sides of the gall-bladder towards the upper surface of the right lobe of the liver. In rare instances the sac ruptures and general peritonitis ensues. Subdiaphragmatic suppuration upon the left side is very rare in cancer, and is chiefly encountered in disease of the lesser curvature close to the cardiac orifice. As a rule the abscess is quite small, and its walls are formed by adhesions in the immediate vicinity of the disease; but when perforation has occurred from the sudden sloughing of the growth, the resulting abscess may closely resemble that which ensues from a simple ulcer in the same situation. In this position its boundaries are remarkably uniform. Above it is limited by the left wing of the diaphragm; below by the upper surface of the left lobe of the liver, and by adhesions between the anterior wall of the stomach and the abdominal parietes; on the right by the falciform ligament; on the left by the spleen, the gastro-splenic omentum, and by adhesions between the cardiac end of the stomach, spleen, and diaphragm; and in front by the abdominal wall and the diaphragm.

In only about one-quarter of the cases can any direct communication be found between the stomach and the abscess, and in such the perforation often involves a large area of the gastric wall. In the rest the aperture has usually been closed before death by proliferation of the growth or by the formation of

adhesions. It is also possible that in some instances the leakage really took place through the spongy substance of the tumour without any actual solution of continuity. When the abscess is small in size, its contents usually consist of thin curdy pus; but in the larger varieties, and in those associated with sloughing of the gastric wall, the inner surface of the sac is often invaded by the neoplasm, and the ichorous fluid it contains is mixed with tags of gangrenous tissue and decomposing food.

Complications.—Owing to its comparatively small size, its distance from the diaphragm, and the low vitality of the patient, a perigastric abscess due to cancer is seldom accompanied by any notable symptoms. When it is encysted behind the stomach, the principal indication of its presence is the development of intermittent pyrexia, accompanied by a rapid increase of the general debility; but should the pus come into contact with the diaphragm, it may set up suppurative inflammation of the pleura or pericardium. If the abscess is situated anteriorly, it may discharge itself at the umbilicus or burst into the colon or duodenum; while in rare instances it ruptures into the cavity of the peritoneum. Perforation of the diaphragm, such as occurs in other varieties, has never been recorded.

6. Perforation of Neighbouring Organs

A. THE SOLID VISCERA

Perigastric adhesions are a frequent cause of the extension of malignant disease to neighbouring tissues, and it is by no means rare to find a large secondary tumour in the substance of a solid viscus immediately contiguous to the cancerous ulcer. Should the latter have perforated the whole thickness of the gastric wall, the process of sloughing or disintegration often spreads to the more recent deposit, with the result that a cavity forms in its centre which communicates directly with the stomach. This condition is most common in connection with soft growths of the lesser curvature, and owing to the size and close proximity of the liver it usually affects the right hepatic lobe. The cavity itself varies from the size of a walnut to that of an orange, and possesses highly vascular walls, which are covered with nodular or fungoid masses. Occasionally a short sinus connects the stomach with the hepatic abscess; while in

rare instances the fusion of several secondary deposits gives rise to a multilocular cavity in the liver, which communicates with the stomach by two or more openings. In those cases where the neoplasm is situated close to the cardiac orifice the left lobe of the liver is more often affected than the right.

The frequent invasion of the gall-bladder by growths of the pylorus usually leads to its complete destruction. Occasionally, however, when bilious obstruction has previously arisen from pressure upon the common duct, subsequent perforation of the gall-bladder gives rise to the formation of a gastro-biliary fistula, but this condition rarely persists.

Implication of the pancreas, with the production of a cavity in its substance, is usually associated with a primary growth of the posterior wall of the stomach. Sometimes large pieces of the gland slough off and are found in the stomach or in the sac of the abscess; or the whole thickness of the organ is destroyed and the malignant disease invades the vertebral column.

Owing to the infrequency of cancer at the fundus, the spleen is rarely destroyed by a primary growth of the stomach, and in only one of our cases (0·4 per cent.) did it contain an abscess which communicated with an aperture in the gastric wall. In one instance a growth of the pylorus was found to have produced a sloughing cavity in the tissue of the uterus, to which it had become adherent. Renal abscess is very rare and almost exclusively met with on the right side.

B. PERFORATION OF THE BOWEL—INTERNAL GASTRIC FISTULÆ

(1) *Gastro-colic Fistula.*—This constitutes the most common form of internal fistula. Brinton noted its existence in eleven out of the 507 cases of gastric cancer which he collected (2·17 per cent.), while Dittrich estimated its frequency at 3·75 per cent. and Lange at 3·8 per cent. Out of 1,142 cases of gastric cancer, including 265 of our own, we find that a fistulous communication existed between the stomach and the colon in thirty, or in 2·5 per cent. In almost every instance the primary growth was situated at the lower border of the stomach, near the pylorus, but Lyon has recorded a case in which it occupied the lesser curvature, and in one of our own series the anterior wall of the fundus was affected. With regard to its mode of formation, it would appear that the fistula may arise in three

ways. In the majority of cases the neoplasm attacks the bowel by direct extension, the two viscera having become previously united by adhesions. Less frequently a large growth forms between the stomach and the bowel, and subsequently infiltrates and destroys the contiguous portions of the two organs. In such the opening is usually found on the posterior aspect of the stomach and at the upper margin or on the anterior surface of the colon, while an irregular sloughing cavity intervenes between the two. Lastly, the gastric disease may set up a localised abscess, either within the lesser sac of the peritoneum or between the great curvature and the transverse colon, which subsequently bursts into the bowel. In this latter variety secondary openings may occur in other directions, and fistulous communications be established not only with the colon, but also with the duodenum, jejunum, or the umbilicus.

(2) *Gastro-intestinal Fistulæ.*—An abnormal communication between the stomach and the small intestine is much less frequent than the preceding. Brinton observed it only once among his 507 cases, but three examples occur in our own series. It is chiefly met with in cases where the stomach has been partially dislocated and the pylorus has contracted adhesions with the small bowel. The perforation of the gut is almost always the result of direct invasion of its walls, and the jejunum is usually affected. When the fistula results from the rupture of a perigastric abscess a secondary communication with the colon is apt to occur. In those exceptional cases where the diseased pylorus occupies the cavity of the pelvis a fistula may be established with the ileum, cæcum, sigmoid flexure, or the rectum.

(3) *Gastro-duodenal Fistula.*—This variety is very rare, and is usually caused by perforation of the posterior wall of the stomach close to the pylorus, whereby a sloughing cavity is formed behind the organ, which finally opens into the second portion of the duodenum. In some cases the pancreas is destroyed in the process, or a fistulous track is established through its substance (Foville). A secondary communication with the colon is not infrequent (Mailliot). Occasionally the pyloric growth directly invades the wall of the bowel, and should the disease also involve the colon, the contents of the duodenum will pass into the large intestine through the intermediate stomach (Osler).

(4) *Bigastric Fistula.*—This occasionally results from an ulcerating growth of the cardiac end of the stomach which has contracted adhesions with the upper part of the pylorus. Kinking and obstruction of the first part of the duodenum usually accompany this condition, and occasionally the involvement of the bowel by the disease leads to the establishment of a gastro-duodenal fistula.

C. PERFORATION OF THE DIAPHRAGM

This must be an extremely rare event, since it was not observed in the course of 1,850 necropsies upon cancer of the stomach, nor have we been able to find a single authentic example of it in the literature upon the subject. Its infrequency may be explained partly by the fact that the vicinity of the cardiac orifice, which is the only region of the stomach where the accident could take place, is very seldom the site of perforation, and partly by the rapidity with which disease in this position tends to produce fatal inanition. When the malignant growth extends into the œsophagus, it occasionally perforates the wall of that tube and lays open the left pleural cavity or the posterior mediastinum.

D. PERFORATION OF THE SKIN—EXTERNAL GASTRIC FISTULÆ

This variety would seem to be even less frequent in cancer than in ulcer of the stomach, since out of the twenty-eight cases of gastro-cutaneous fistula collected by Murchison, twelve were due to the simple and only six to malignant disease. Moreover, the records of 1,142 necropsies upon cancer of the stomach contain only three instances of external fistula (0·26 per cent.), while a careful search through the literature reveals only nineteen examples of this affection. In those cases where the fistula was established spontaneously it was usually situated at the umbilicus, but when it resulted from surgical interference it was sometimes located in the epigastrium or in the left hypochondrium. In the majority only one sinus existed, but in the case reported by Murchison there were two, while in another there were several (Coote). The external orifice varied considerably in size, in two cases being only large enough to admit a fine probe, while in the rest a cannula or

even the forefinger could be inserted into it. In one instance only it possessed the diameter of a shilling (Cameron). In every case the external fistula communicated with the stomach through the medium of an abscess which was bounded behind by the stomach, the left lobe of the liver, and the colon, in front by the abdominal wall, and at the sides by adhesions between the aforementioned viscera and the parietes. In fifteen out of seventeen cases the primary disease was situated at the pylorus, which was usually adherent to the anterior wall of the abdomen, while in the other two the growth affected one or other curvature. An obvious perforation of the stomach existed in twelve cases, and was invariably situated upon the anterior wall. It varied in size from a small chink to an aperture several inches square. The malignant disease was always of the spheroidal-celled type, and in two instances presented colloid changes.

Contrast of Perforation in Cancer with that in Simple Ulcer.—A simple ulcer is far more prone to perforate the wall of the stomach than a cancerous growth. According to our clinical statistics this accident occurs in 7 per cent. of all chronic ulcers,[1] but only in 3 per cent. of the cases of malignant disease. The disproportionate tendency to perforation which is thus exhibited by the simple disease is further emphasised when post-mortem evidence is solely relied upon, for we found that out of 678 necropsies in which an open ulcer was present, perforation with general peritonitis had taken place in 153, or in 22·5 per cent., while in 1,062 fatal cases of gastric cancer a similar condition existed only in thirty-three, or in 3 per cent. Consequently, as a cause of death, perforation is more than seven times as frequent in ulcer as in cancer. The explanation of this phenomenon is to be found in the different pathology of the two complaints. In simple ulcer the necrotic process is limited to a small area of the gastric wall, and any peritonitis that may develop around the base of the disease is strictly circumscribed. It therefore happens that by the time the peritoneum is exposed the sole obstacle to perforation lies in the fortuitous adhesion of some contiguous organ. A malignant growth, on the other hand, is usually attended by extensive adhesions as soon as the muscular coat

[1] *Ulcer of the Stomach and Duodenum*, p. 200. This estimate includes scars as well as open ulcers.

has become involved, while, *pari passu* with the loss of substance internally, the base of the ulcer is thickened by the growth of fresh material. Indeed, it is only when rapid sloughing occurs and the process of destruction outruns that of repair that the danger of perforation becomes imminent.

The seat of election of the two diseases also exerts an important influence upon their respective proclivity to perforation. An ulcer affects the anterior wall in about 8 per cent. of all cases in which it occurs, but in cancer the percentage incidence of the growth in this position does not exceed 2; and since this part of the stomach is more liable to perforation than any other, owing to the almost invariable absence of protective adhesions, it follows that the accident must be most frequent in the simple complaint. For a similar reason general peritonitis is the usual result of the perforation of the stomach by a simple ulcer, while in carcinoma a localised abscess develops in about one-third of the cases. With regard to the establishment of internal fistulæ, it is worthy of note that a gastro-colic fistula is twice as frequent in cancer as in ulcer, and that abnormal communications between the stomach and other parts of the intestinal tract are practically confined to the malignant complaint. On the other hand, the more frequent incidence of simple ulcer upon the anterior wall of the viscus renders this disease far more liable to produce an external fistula, and also permits the occasional perforation of the diaphragm.

7. Invasion of other Viscera and Secondary Growths

Carcinoma of the stomach often exhibits an extreme degree of malignancy, and almost always extends beyond the confines of the organ before death. As the result of Brinton's researches it is usually taught that secondary deposits occur in about 50 per cent. of all cases, although Welch concluded from a study of much larger statistics that they are present in at least 63 per cent.[1] These and other similar figures, however, only refer to such growths of a metastatic character as were visible to the naked eye, and do not indicate in any way the frequency with which the disease had invaded the lymphatic vessels outside

[1] It is noteworthy that modern writers give a much higher percentage of secondary growths, viz. Ewald 75, Perry and Shaw 80, and Osler and McCrae 86.

the stomach, and had produced a very real, though perhaps an invisible, infection of the neighbouring viscera.

That extensive dissemination usually occurs even in cases which present no obvious metastases is readily proved by a microscopical examination, for it is found that not only the stomach itself at some distance from the disease, but the perigastric lymphatic glands, the omenta and peritoneal aspect of the diaphragm, present numerous groups of cells which are identical in character with those of the original tumour. It is also the unhappy experience of most surgeons who have been tempted to extirpate an apparently localised and uncomplicated growth of the pylorus, to find that within a comparatively short time a recurrence occurred in one or other of these situations. We are consequently led to infer that almost from its commencement the neoplasm tends to infect the submucous tissue for a considerable distance around its centre of activity, and that within the course of a few weeks some of its epithelial elements gain access to the lymphatic system.

But although a visible extension of the disease to the surrounding viscera constitutes a very crude indication of its distribution, the presence of secondary deposits is of considerable importance from a clinical standpoint, since they not only give rise to important physical signs, but exert a marked influence upon the duration of the complaint. It is therefore convenient to determine as far as possible their relative frequency in different organs, and the means by which the diffusion of the cancer cells is effected.

Out of 131 cases of gastric cancer in which all the organs of the body were carefully examined, we find that the growth had extended beyond the walls of the stomach in 113, or in 86 per cent. The following table shows the percentage frequency with which the various tissues were affected, and also affords a contrast with the conclusions formed by Welch and Lebert.

It will be observed that in several respects our conclusions differ materially from those arrived at by other writers. In the first place, the percentage frequency of glandular infection is twice as great as that usually accepted. This may be explained partly by the difficulty of detecting a few small glands among a mass of adhesions unless a special search is made for them, and partly by the fact that many morbid anatomists allow the existence of disease only when the glands exhibit

TABLE 6.—AN ANALYSIS OF 131 CASES OF GASTRIC CANCER, SHOWING THE FREQUENCY WITH WHICH THE VARIOUS OTHER ORGANS WERE AFFECTED BY THE DISEASE

Organ	No. of cases	Percentage	Welch	Lebert
Lymphatic glands (enlarged)	104	79·4	35 %	54·5%
Liver [1]	65	50	30·2%	40·9%
Peritoneum (and omenta)	46	35		37·5%
Small intestine	2	1·5	22·7%	10 2%
Large intestine	8	6		
Pancreas	25	19	7·8%	7 %
Kidney	5	3·7	—	8 %
Adrenals	3	2·3	—	
Spleen	5	3·7	1·7%	5·7%
Pleura	6	4·5	6·2%	8·3%
Lungs	10	7·6		
Heart	3	2·3	—	6 % (+ pericardium)
Uterus	2	1 5	—	4·5%
Ovary	3	2·3	—	
Bladder	2	1·5	—	—
Bones	2	1·5	—	3·5%
Brain	1	·7	·6%	4·5%
Skin	3	2·3	—	3 %
Supraclavicular glands	4	3	—	—
Mediastinal glands	14	10·6	—	—

visible nodules of growth. Since, however, we have found that every swollen gland in the vicinity of a cancerous stomach shows signs of infection when examined by the microscope, we prefer to regard any enlargement which is apparent to the naked eye as indicative of disease.

In the second place, the liver and pancreas appear to be unduly affected in our cases, because we have recorded every instance in which they were involved by the growth, instead of drawing a distinction between invasions by contiguity and true metastases. Our reason in so doing is to emphasise the rapid and widespread dissemination of a gastric cancer, the importance of which is apt to be underrated when only metastatic growths are considered worthy of attention. It might also be urged that the pathological distinction between secondary deposits and direct invasions is often more apparent than real. Thus, in many cases where true metastases are scattered through the substance of the liver, the infection of the portal system may be shown to have taken place through the medium

[1] The exact figures in this case were: multiple discrete tumours = forty-seven, or 35·8 per cent.; direct invasions = eighteen, or 13·7 per cent.

of a mass of growth which had spread into it from the adherent stomach; while in the case of the omentum it is often impossible to determine whether the induration was primarily due to extension by the lymphatics, or to direct invasion from the peritoneal surface of the growth.

The liability of the different organs to infection varies with the situation of the primary disease in the stomach. In some cases this chiefly depends upon the relative proximity of the viscus in question to the growth, as, for example, the invasion of the pancreas by tumours of the posterior surface of the stomach and of the spleen by those of the fundus. In others, however, it is the type of the disease rather than its location which seems to be responsible for its greater infectivity. It will be seen in the following table that cancers of the pylorus which cause constriction of the orifice comparatively rarely affect the liver, for the reason that they are usually scirrhus; while those which attack the body of the organ or the cardia are particularly destructive of other tissues, because they so often possess a medullary or cylindrical-cell structure. Lastly, it will be noticed that the peritoneum is exceptionally prone to suffer when the whole or greater part of the gastric wall is invaded by the disease.

TABLE 7.—RELATIVE FREQUENCY OF METASTASES IN CANCER OF DIFFERENT REGIONS OF THE STOMACH

Situation of disease	Pylorus (with stenosis)	Pylorus (without stenosis)	Walls and curvatures	Cardia	Whole or greater part of organ
Glands . .	60%	85%	93%	89%	87%
Liver . . .	24%	64%	70%	84%	37%
Peritoneum . .	30%	36%	26%	46%	75%
Pancreas . .	18%	14%	30%	7%	25%
Lungs . . .	3·7%	6%	13%	7%	9%
Pleura . . .	3·7%	6%	4%	7%	25%
Spleen . . .	—	3%	4%	14%	6%
Kidneys . .	1·9%	4%	4%	14%	1%

Carcinoma of the stomach may lead to the invasion of other viscera in several different ways, viz., by direct extension into the surrounding tissues; by infection of the lymphatic and blood streams; by the detachment of small particles, and their subsequent transplantation upon serous or mucous surfaces; or by local contact.

A. DIRECT INVASION

The fact that a morbid growth invariably invades the submucous tissue for some distance beyond its apparent confines suggests that it would frequently extend by continuity into the œsophagus or duodenum. As a matter of fact, however, such a process is comparatively rare as compared with the invasion of merely contiguous structures. Thus, out of the 131 cases already referred to, we find that the pancreas was directly invaded in twenty-two, or 16·7 per cent.; the liver in eighteen, or 13·7 per cent.; the colon in seven, or 5·3 per cent.; the spleen in five, or 3·7 per cent.; the œsophagus in eight, or 4·5 per cent.; and the duodenum in two, or 1·5 per cent. The preference thus exhibited to invasion *via* the peritoneum probably depends upon the peculiar facilities which the latter affords, by its extensive system of lymphatics and by the numerous bridges which exist, in the form of fibrinous adhesions, for the transference of cancer cells from one organ to the other. The exceptional liability of the pancreas is probably the result of three allied conditions. In the first place, its situation immediately behind the stomach not only brings it into close contact with almost every growth which affects that viscus, but also with those species (medullary and adeno-carcinomata) which possess the greatest degree of malignancy. Again, the firm structure of the gland and its fixed position greatly conduce to the formation of adhesions and to their subsequent invasion by the disease. Finally, the close proximity of the cœliac glands and of the great lymphatic vessels which drain the lower half of the stomach must always be a source of considerable danger to the organ.

The situation of the liver renders it less exposed to direct invasion, since it only comes into contact with the upper margin and a part of the anterior surface of the stomach, while its constant movement during respiration militates against the formation of adhesions. These natural advantages are, however, more than counterbalanced by its connection with the lesser omentum and the vessels it contains, since these constitute a means of communication with the diseased stomach, of which the neoplasm only too often takes advantage.

The spleen is much less frequently invaded than the aforementioned organs, owing to its remote situation from the usual

seat of disease and to the peculiar distribution of the gastric lymphatics. If, however, only those cases are examined in which the growth affects the cardiac end of the stomach, this disparity at once disappears (*vide* Table 7, p. 56). For a similar reason the transverse colon is only directly implicated in about 5·3 per cent. of all cases of gastric cancer, but in nearly 32 per cent. of those in which the great curvature is the seat of the primary growth. Direct invasion of the kidney is very rare; but a similar immunity is not shared by the suprarenal glands, which are frequently involved (especially the left one) in disease of the posterior surface of the stomach and of the cardia.

FIG. 26.—A large growth of cylindrical-celled carcinoma at the pylorus, extending into the duodenum. (Museum of the Royal College of Surgeons.)

Turning now to the question of invasion by continuity, it is at once obvious that a great difference exists between the respective liability of the duodenum and the œsophagus. A pyloric growth, if it spreads at all, almost always extends in the direction of the body of the viscus, and though it may actually project into the lumen of the duodenum, but rarely implicates its walls. Lebert observed one exception to this rule in the course of thirty-four necropsies upon cancer of the pylorus, Brinton ten in 125, and ourselves two in eighty-seven. Thus, out of a total of 246 cases, a pyloric growth involved the duodenum in only thirteen, or 5·2 per cent. It also seems that

the cylinder-cell variety more often affects the bowel than the other forms.

On the other hand, the natural tendency for a cancer of the cardia is to spread into the walls of the œsophagus. When the disease develops in the immediate vicinity of the orifice, this mode of extension probably occurs in every case (Rokitansky); but when it primarily implicates the walls or curvatures at some distance from the aperture, we find that invasion of the œsophagus takes place only in about one-half of the cases (46 per cent.).

The notable difference which is thus observed in the spread of a neoplasm at opposite ends of the organ is best explained by contrasting the mode of insertion of the œsophagus into the stomach with that of the pylorus into the duodenum. In the former case the submucous and muscular coats of the two viscera are perfectly continuous, and there is, consequently, no

FIG. 27.—A soft spheroidal-celled growth of the cardiac orifice extending up the œsophagus. (London Hospital Museum.)

obstacle to the spread of a morbid growth from one organ to the other. The duodenum, on the other hand, is attached to the pylorus much in the same way as the vagina embraces the neck of the uterus, the submucous and the inner and muscular coats of the two viscera along the line of fusion being so distinct from one another that direct continuity can scarcely be said to exist. It consequently happens that a growth of the pylorus is more apt to infiltrate the contiguous walls of the stomach than to extend obliquely along a comparatively thin and external layer of tissue into the wall of the bowel. It is also probable that the lymphatic vessels of the pylorus, by pursuing a course away from the bowel towards the cardia or the pancreas, also tend to promote extension of the disease in an opposite direction to the duodenum.

The appearances presented by the organs directly invaded by carcinoma vary considerably in different cases. When the pancreas is affected the whole or greater portion of the gland is usually destroyed; but in the case of the liver and spleen the disease more often takes the form of a globular or wedge-shaped mass, which extends only a short distance into their interior, but is accompanied by great infiltration of the sub-serous tissue and lymphatic glands. Extension to the colon takes place through the medium of the gastro-colic omentum and newly formed adhesions, and not infrequently gives rise to a large mass of growth between the stomach and the bowel, which greatly obstructs the lumen of the latter. Invasion of the œsophagus occurs most frequently in soft spheroidal-celled cancers, and either affects the entire circumference of the tube for half an inch or more above the cardiac orifice, or produces an irregular infiltration of its posterior and inner wall. This latter variety often leads to perforation. More rarely the sub-mucous tissue of the œsophagus is invaded by one or more series of nodules, which extend for some distance in its long axis and may even reach the pharynx (Lazarus-Barlow). These occasionally ulcerate and produce small circular sores. When the disease invades the duodenum it seldom involves more than two inches of the bowel.

B. LYMPHATIC INFECTION

The epithelial offshoots from a cancerous tumour penetrate the surrounding structures in the direction of the least resistance, and therefore soon find their way into the spaces in the connective tissue which constitute the radicles of the gastric lymphatics. After gaining an entrance to the lymph stream the cells are gradually swept onwards until they are arrested in the nearest lymphatic gland, when they undergo multiplication and reproduce the structure of the original tumour. Subsequently the efferent vessels of the gland become in their turn the means of transmitting the disease to its neighbour, and thus the process goes on until the whole lymphatic system is infected. In order to gain a clear conception of the various routes by which such a generalisation is brought about, it is necessary to bear in mind the general arrangement of the gastric lymphatics and of those of the surrounding viscera.

The *Lymphatics of the Stomach* commence in the mucous coat, and thence follow the blood-vessels to the subserous tissue. Some pursue an upward course towards the lesser curvature, others pass downwards to the greater curvature, while others again run across the fundus to the gastro-splenic omentum. In this way three principal groups of vessels are formed—the superior gastric, the inferior gastric, and those belonging to the fundus, or the left gastric lymphatics as they are sometimes called.

The *Superior Gastric Lymphatics* follow the course of the coronary vein along the small curvature between the layers of the lesser omentum. After passing through the superior gastric glands they turn backwards near the cardiac orifice and enter the cœliac glands. The *Inferior Gastric Lymphatics* direct their course towards the pylorus in company with the right gastro-epiploic vessels, and after passing through the inferior gastric glands and joining the lymphatics from the upper duodenum they pass between the pylorus and the pancreas to the cœliac glands.

The *Left Gastric Lymphatics* accompany the vasa brevia between the folds of the gastro-splenic omentum and terminate in the glands at the hilus of the spleen. There are also several lymphatics which run directly from the pylorus to the hepatic glands in the lesser omentum.

The *Lymphatic Glands of the Stomach* consist of two groups, the superior and the inferior.

The *Superior Gastric Glands* are usually five or six in number, and are situated along the upper margin of the organ between the layers of the gastro-hepatic omentum. They receive the superior gastric lymphatics, and their efferent ducts pass in the manner already described to the cœliac glands.

The *Inferior Gastric* or *Gastro-epiploic Glands*, seven or eight in number, lie between the folds of the large omentum

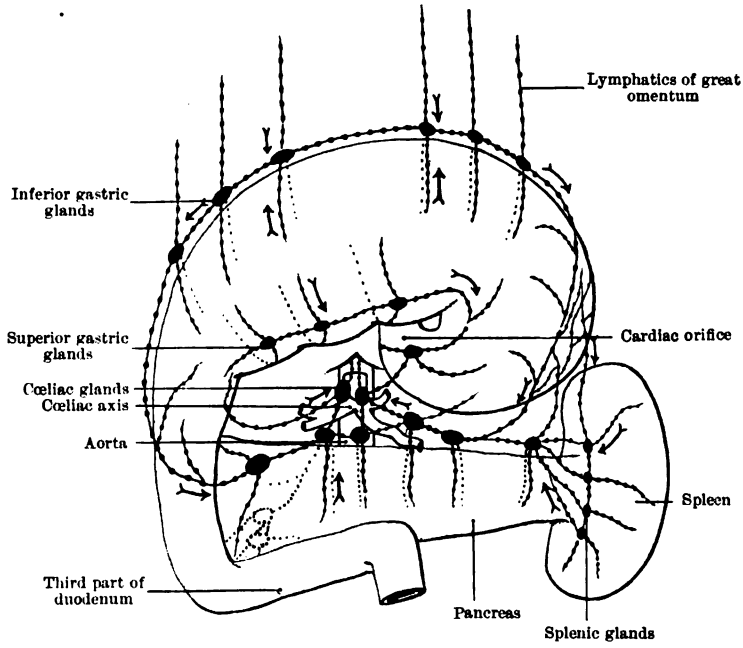


FIG. 28.—Diagram of the lymphatics of the stomach. (C. H. Leaf.)

along the great curvature. They receive the inferior gastric lymphatics and also those of the omentum. Their efferent vessels empty themselves into the cœliac glands.

The *Cœliac Glands*, about twenty in number, are clustered around the cœliac axis in front of the aorta and above the origin of the superior mesenteric artery. They receive the efferent vessels of the superior and inferior gastric, splenic and pancreatic glands, and some of those of the hepatic glands. Their ducts join the intestinal lymphatic trunks and open into the receptaculum chyli.

The *Mesenteric Glands* lie between the layers of the mesentery, and number from one hundred and fifty to two hundred. Their efferent vessels unite to form one or more trunks (intestinal lymphatic trunks), which after receiving the efferent vessels of the mesocolic glands open with the ducts of the cœliac glands into the receptaculum chyli.

The *Sacral and Lumbar Glands* are situated respectively in the hollow of the sacrum and upon the fronts and sides of the lumbar vertebræ. Their efferent vessels enter the receptaculum chyli.

The *Lymphatic Vessels* of the *Liver* consist of a superficial and a deep set. The former ramify beneath the peritoneal investment, and partly converge to the diaphragm and enter the anterior mediastinal glands, and partly towards the anterior margin of the organ on their way to the hepatic or cœliac glands. The deep vessels accompany the branches of the portal and hepatic veins, and are directed respectively into the hepatic glands and the receptaculum chyli.

The *Lymphatics* of the *Spleen and the Pancreas* usually unite and enter the cœliac glands.

The *Diaphragmatic Lymphatics* follow the blood-vessels and terminate anteriorly in the internal mammary and anterior mediastinal glands, and posteriorly in the posterior mediastinal glands.

The *Anterior Mediastinal Glands* lie behind the sternum. They receive the lymphatics of the antero-median portion of the diaphragm and those from the convex surface of the right lobe of the liver. Their efferent ducts pass upwards to the superior mediastinal glands.

The *Superior Mediastinal Glands* lie in front of the upper part of the pericardium, the arch of the aorta, and the left innominate vein. Their efferent vessels pass along the sides of the trachea to join the thoracic duct or the right lymphatic duct.

The *Posterior Mediastinal Glands* are placed in the posterior mediastinum along the course of the aorta. They receive lymphatics from the œsophagus, from the posterior part of the diaphragm, and from the right border of the liver. Their efferent vessels pass chiefly into the thoracic duct, but some enter the bronchial glands.

The *Receptaculum Chyli* lies between the aorta and the

right crus of the diaphragm upon the body of the second lumbar vertebra. It receives the efferent vessels of the lumbar and cœliac glands, the intestinal lymphatic trunks, and some of the hepatic and gastric lymphatics. From it springs the thoracic duct, which enters the thorax by the aortic opening of the diaphragm, runs up the posterior mediastinum, and, leaving the chest at the superior opening on the left side, enters the junction of the left internal jugular and subclavian veins.

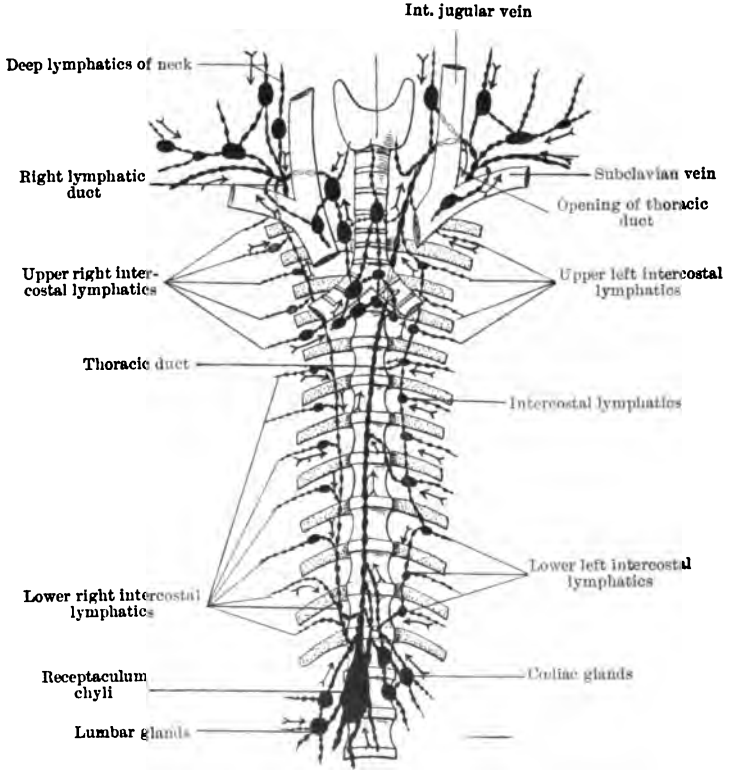


FIG. 29.—Diagram of the thoracic duct and its tributaries. (C. H. Leaf.)

This brief review of the lymphatic system of the stomach and its principal connections serves to illustrate three important points. In the first place, the stomach itself would seem to be naturally divided into three lymphatic areas, each of which is provided with a separate set of glands. The upper or superior area corresponds to the upper halves of both surfaces from the

pylorus to the junction of the central third with the fundus, and is drained by the vessels which proceed to the superior gastric glands. The inferior area includes the lower halves of the pyloric and central portions of the viscus, and its lymphatics pass to the inferior gastric glands; while the fundus, or left area of the organ, is connected with the glands situated at the hilus of the spleen. In the second place, the cœliac glands, by receiving the efferent vessels of each of these groups, are not only liable themselves to become invaded by cancer of any part of the stomach, but also to act as a centre for the distribution of infection to the other lymphatic systems with which they are immediately connected. Finally, the receptaculum chyli, being the reservoir into which the cœliac glands pour their lymph, tends to infect the mesenteric and lumbar glands and the various tributaries of the thoracic duct. The superior gastric glands are more often affected than the other groups, by reason of the abnormal frequency of carcinoma in the upper segment of the stomach. As a rule every member of the series is more or less implicated, but should the primary growth be limited to the cardiac orifice only one or two of the nearest may show signs of enlargement, since the lymphatics of this region pass directly to the cœliac group. Secondary carcinoma of the glands along the lesser curvature often leads to disease of those in the portal fissure, which in their turn diffuse the infection through the superficial lymphatics of the liver to the diaphragm and the pleuræ. That this mode of extension is of considerable importance is shown by the fact that in 34 per cent. of our cases where the superior gastric glands were diseased miliary growths were present upon the lower surface of the diaphragm.

Carcinoma of the pylorus usually involves both the upper and lower systems of lymphatics, and, besides giving rise to enlargement of the superior chain of glands, leads to direct infection of the cœliac group by the efferent vessels of the inferior chain which pass behind the pylorus. This fact indicates that any operation devised for the excision of a pyloric growth must include the removal not only of the superficial glands, but also of those which are clustered behind the organ and around the cœliac axis.

The *inferior gastric glands* are chiefly involved when the neoplasm affects the great curvature. Occasionally their en-

largement gives rise to a growth between the stomach and the colon, which invades the bowel, or, by exerting pressure upon a nutrient vessel, induces gangrene of its walls (Goullioud and Mallard). More frequently the mischief spreads into the lymphatics of the great omentum, and converts that tissue into a sausage-shaped mass, which lies transversely across the epigastrium upon the anterior surface of the stomach.

Extension of the disease to the general peritoneum is accompanied by the formation of numerous discrete nodules upon the surface of the serous membrane, which vary from the size of a hempseed to that of a walnut. This cancerous peritonitis, besides being one of the chief causes of ascites in gastric carcinoma, is also responsible for several phenomena of clinical interest. In the first place, it is liable, like other varieties of peritonitis, to produce infection of the lymphatics of the diaphragm, or to be followed by carcinosis of the pleuræ and pericardium. Secondly, its invasion of the mesentery and the mesocolon may be accompanied by so much contraction of these structures that the intestines are drawn backwards to the spine and their presence obscured by the coexisting ascites. Thirdly, the inflammation occasionally extends into the subserous areolar tissue, which becomes greatly indurated and thickened, and not only gives rise to compression of the blood-vessels it contains, but may even produce obstruction of the ureters (Bouveret). Fourthly, a large peritoneal growth in the pelvis often contracts adhesions with the neighbouring viscera, the tissues of which it subsequently invades and destroys. In this manner the ovaries, uterus, rectum, bladder, or prostate may become the seat of a secondary disease, the symptoms of which may quite overshadow those of the primary growth. Finally, disease of the peritoneum in the upper part of the abdomen is not infrequently followed by an invasion of the abdominal parietes or by secondary deposits in the skin. In the former case the neoplasm usually spreads to the linea alba, and produces a line of thickening which extends from the ensiform cartilage to the navel, or even to the pubes. In the latter the lymphatics of the round or of the falciform ligament convey the disease to the umbilicus, which becomes retracted and fixed, and may subsequently present one or more cutaneous nodules. This condition is sometimes associated with multiple growths in the subcutaneous tissue of the abdomen, back, or thorax, which are

usually ascribed to infection of the systemic arteries. As, however, this explanation does not account for the limitation of the disease to the trunk, we prefer to attribute it to a direct extension by the parietal lymphatics; and, in two cases where the skin of the thorax exhibited numerous nodules, we were able to prove after death that the mischief had spread from the anterior mediastinum into the intercostal glands, and thence into the intercostal lymphatic vessels.

The *cœliac glands* constitute an important intermediate centre between the stomach and the receptaculum chyli. They are often much enlarged in growths of the cardia and of the posterior wall, and sometimes form a nodular tumour, which can be detected during life. Softening and ulceration of their substance may lead to occlusion of the inferior vena cava or to destruction of the vertebral column (Brun). In nearly every case they transmit the disease to their pancreatic, hepatic, and splenic tributaries.

Invasion of the *receptaculum chyli* marks the last stage in the process of lymphatic infection. Through the medium of this reservoir the disease may be propagated backwards to the mesenteric, lumbar, and sacral glands, and thence to those situated along the course of the iliac vessels and in the inguinal region. Extension of the mischief in an upward direction takes place through the thoracic duct, which is sometimes found to be diseased throughout its entire length or occluded by masses of cancer cells (Fenger).

This condition is usually associated with extensive infiltration of the glands in the posterior mediastinum and of those at the roots of the lungs and at the bifurcation of the trachea. In about 3 per cent. of all cases of gastric cancer a glandular enlargement occurs above the left clavicle, owing to the infection of the cervical tributaries of the thoracic duct, while in rare cases a similar condition above the right clavicle indicates the involvement of the right lymphatic duct.

C. VASCULAR INFECTION

Carcinoma of the stomach is apt to involve the vessels in its neighbourhood either by direct extension or through the medium of the lymphatics. As a rule the veins are more affected than the arteries, and, in addition to a general infiltration of their walls, they not infrequently present masses of epithelial

cells which project into their lumina. These small vegetations are liable to be swept off and to be carried by the blood into other viscera, where they develop into tumours of the same structure as the original growth. In other cases the vein becomes occluded by clot and the thrombus is subsequently infiltrated by cancer cells.

The fact that the veins of the stomach are chiefly directed into the portal system is sufficient to explain the inordinate frequency of metastatic deposits in the liver. These vary greatly both in number and size; in some cases only one or two small nodules being present, while in others the whole organ seems to be converted into a mass of cancer. Secondary disease of the liver is most common in carcinoma of the central and cardiac regions of the stomach, and its development is often excessive when compared with the size of the original tumour. On the other hand, growths of the pylorus which produce contraction of the orifice are rarely accompanied by metastases in the liver (Table 7, p. 56). Occasionally the venous infection is limited to the wall of the stomach and is accompanied by thrombosis of the coronary, epiploic, or pyloric veins; but as a rule the portal trunk itself is affected, and becomes partially filled with masses of cancer (Pressat, Rendu), or even completely obstructed by them (Labbé, Contour).

Carcinoma may infect the blood of the systemic veins in three ways: by direct invasion of the inferior vena cava, by the extension to the hepatic veins of a growth of the liver, or by lymph conveyed through the thoracic or right lymphatic ducts. In every case its first effect is to produce secondary deposits in the lungs, a condition which is met with in nearly 8 per cent. of all cancers of the stomach. These metastases usually develop in the lower lobes, where they form rounded compact tumours of considerable size; but occasionally they take the form of a miliary growth at one or other apex. The latter variety may closely resemble tubercle, both in its general appearance and also in its tendency to undergo softening and caseation. Brinton seems to have been convinced that implication of the liver greatly diminished the risk of pulmonary infection; but this view has not been supported by subsequent writers, nor does the fact that the liver was affected in 80 per cent. of our cases which presented pulmonary growths permit us to endorse it. Cancerous infection of the arterial system

may be local or general. The former is chiefly observed in cases where the gastric growth has invaded the hepatic, coronary, or renal arteries, while the latter is nearly always the result of infection of the systemic veins. The fact that in cases of general infection the lungs are not always the seat of secondary growths seems to indicate that cancer cells are capable of passing through the pulmonary capillaries without producing embolism. After gaining an entrance to the left side of the heart, the morbid particles are immediately directed into the systemic arteries, and in this way may disseminate the disease throughout the body. The principal organs affected in this manner are, in their order of frequency—kidneys (4 per cent.), heart (2·3 per cent.), ovaries (2·3 per cent.), spleen (2 per cent.), bones (2 per cent.), uterus (1·5 per cent.), large intestine (·7 per cent.), and brain (·7 per cent.). The bones usually affected are the sternum, humerus (Marrotte), and sacrum (Bouveret); while disease of the brain is interesting, in that it is almost invariably associated with a tumour of the lung.

D. TRANSPLANTATION

This is chiefly observed in the case of the peritoneum, where the implication of the serous coat of the stomach or of the great omentum is sometimes followed by the development of cancer in the lower abdomen. In such cases it is probable that small clumps of cancer cells become detached, and, being aided by the force of gravity, fall like seed into one of the pelvic pouches and subsequently develop. Transplantation upon mucous membranes is not infrequently observed in cases of cancer of the stomach secondary to disease of the œsophagus or the mouth (p. 26).

E. CONTACT INFECTION

This has already been described in the chapter upon Morbid Anatomy (p. 23).

8. Jaundice

This was present in 13·7 per cent. of our cases at the time of death. Its frequency varies according to the situation of the growth in the stomach. Thus it occurred in 35 per cent. of the cases where the disease affected the lesser curvature or the posterior wall; in 20·5 per cent. of the pyloric

infiltrations unaccompanied by stenosis or dilatation of the stomach; in 7 per cent. of the growths limited to the cardia, and only in 5·6 per cent. of those which had produced great contraction of the pylorus. With regard to the causation of the icterus, it was noted that either the head of the pancreas was infiltrated or the bile duct was obstructed in four-fifths of the cases, while in the remainder the liver was the seat of numerous secondary deposits. In rare instances enlargement of the lymphatic glands in the portal fissure exerts pressure upon the hepatic duct at an early period of the disease (Michel).

9. Ascites

An excess of fluid in the peritoneal cavity was noted in 26 per cent. of our cases. The amount varied from six ounces to several quarts, the average being about two and a half pints. As a rule the fluid was clear, and of a pale yellow or straw colour, but occasionally it was slightly turbid or presented the appearance of thin pus. In two cases (0·75 per cent.) chylous ascites was observed. When associated with jaundice the effusion was always bile-stained, but in two cases this feature was observed although the skin and the conjunctivæ retained their natural colour. This phenomenon seems to have been due to the obstruction of the thoracic duct, which was present in both instances, and which probably prevented the entrance of the bile pigment into the general circulation. Blood or blood-stained exudation existed in rather less than one quarter (23 per cent.) of the cases of ascites, and was usually attributable to the presence of soft hæmorrhagic growths upon the peritoneum, but in two instances there was coexistent thrombosis of the portal vein.

The causation of ascites in gastric cancer is a matter of some importance. We find that in 50 per cent. of our cases in which it occurred the peritoneum was the seat of an extensive carcinosis, but the liver was free from disease; in 21 per cent. metastases were present in the liver, but the peritoneum was healthy; while in the remaining 29 per cent. both structures were affected with secondary growths. It is therefore obvious that the extension of cancer to the peritoneum is by far the most important factor in its production.

The analysis recorded in Table 8 indicates that ascites only

occurs in about 13 per cent. of the cases where the pylorus is contracted, while 50 per cent. of the growths of the cardia and 75 per cent. of those which infiltrate the entire viscus are accompanied by peritoneal effusion. A comparison of these figures with those contained in Table 7 is sufficient to explain this curious fact, for it will be observed that neoplasms of the central or cardiac region of the stomach are not only more malignant than those which stenose the pylorus, but are especially prone to invade the peritoneum.

TABLE 8.—SHOWING THE PERCENTAGE FREQUENCY OF ASCITES IN CARCINOMA OF DIFFERENT REGIONS OF THE STOMACH, AND ITS ASSOCIATION WITH SECONDARY GROWTHS OF THE PERITONEUM AND LIVER

Situation of the gastric disease	Ascites present	Secondary growths in cases of ascites		
		Peritoneum only	Liver only	Both
Pylorus (with stenosis) . . .	13·2%	67%	33%	—
Pylorus (without stenosis) . . .	20·6%	14%	14%	72%
Walls and curvatures	34%	50%	37·5%	12·5%
Cardia	53·8%	55·5%	11%	33·3%
General infiltration	75%	50%	16·6%	33·3%

10. Thrombosis

The formation of a clot in a vessel is not an infrequent event during the later stages of cancer of the stomach. As a rule the veins are more often affected than the arteries, especially those of the lower extremities. Thrombosis of the common iliac, femoral, or saphenous veins was observed in 4·5 per cent. of our cases. The condition appears to be due partly to the general debility that exists towards the end of life, and partly to the feeble action of the heart which ensues from the wasting and degeneration of its tissues. It is especially frequent in cases where the growth occupies the posterior wall of the stomach and is accompanied by intense anæmia (latent cancer). The basilic or cephalic veins of the arm, or the internal jugulars (Bouveret), are occasionally obstructed, while in rare instances most of the superficial veins of both the upper and lower extremities may be affected (Osler).

Thrombosis of the veins within the abdomen or thorax is usually due to their direct invasion by the growth. For this

reason the portal trunk is most often affected, although sometimes its splenic or mesenteric tributaries are also involved. Portal thrombosis was noted in 3 per cent. of our cases, but it is probable that this figure underrates the frequency with which it takes place. Suppurative inflammation of the vein has been observed (Legg). Less frequently the inferior vena cava is invaded by a growth of the posterior surface of the stomach, or the hepatic veins by a secondary tumour of the liver; while in one of our cases a metastasis in the superior mediastinum led to thrombosis of the right innominate vein and its tributaries.

Thrombosis of arteries is comparatively rare, and is usually preceded by atheroma, unless the vessel is directly involved by the neoplasm. It has been observed to take place in the middle cerebral (Merklen, Flint), posterior tibial, and left subclavian (Langlet), as well as in the splenic, hepatic, colic, mesenteric, and renal trunks. In one case we found simultaneous occlusion of the splenic, right renal, and right posterior tibial arteries. Ante-mortem clots in the cavities of the heart and in the pulmonary artery are usually present when death has been preceded by coma.

11. Diseases of other Organs

A careful examination of the various tissues of the body after death from cancer of the stomach brings to light two important facts. In the first place, it would appear that although the disease may be attended by many and diverse complications, it is seldom preceded by organic changes in other viscera; in other words, carcinoma is particularly prone to attack those who have enjoyed an exceptional immunity from disease. Thus, in only 17 per cent. of our cases was there any indication of antecedent mischief in an important organ; whereas in chronic ulcer, which occurs at an earlier period of life, some old-standing lesion of the lungs, heart, liver, or kidneys is found in at least 40 per cent. In the second place, in those cases in which tuberculosis and gastric cancer coexist in the same individual, it is almost invariably found that the former has become quiescent or even completely obsolescent before the onset of the latter; indeed, in the whole of our experience we are unable to call to mind more than two or three instances where active tuberculosis was present along with a cancerous growth in the stomach. In this

connection the statements of Rokitansky regarding the incompatibility of the two diseases are of special interest.

(*a*) **The Heart.**—The heart participates in the general wasting, and consequently appears after death to be remarkably small. According to our statistics its average weight in the male cases was 8·2 oz. and in the female 7·5 oz.; and since the normal average in the two sexes is 11 oz. and 9 oz. respectively, it would seem that the organ usually loses about one quarter of its initial weight during the course of the complaint. The smallest heart (3½ oz.) recorded in our series was taken from a young man who died from pyloric stenosis, and Habershon met with one of similar weight in a woman forty years of age. An increase of size almost always indicates the existence of old endocarditis. As a rule the walls of the organ are flaccid, and its cavities contain decolorised as well as recent clot. The muscular tissue is usually flabby, friable, and either pale or dark brown in colour, and on microscopical examination the fibres are often found to be remarkably attenuated, and not infrequently to present signs of fatty degeneration. An excess of fluid in the pericardium was only met with in 4 per cent. of our cases, and acute pericarditis was present in only two instances (·7 per cent.), in both of which it was secondary to suppurative pleurisy on the left side.

Chronic endocarditis existed in 4·6 per cent., acute ulcerative endocarditis in 2·3 per cent., while small recent vegetations upon the mitral or aortic cusps were observed in nearly 4 per cent. In every case of recent endocarditis the growth in the stomach was extensively ulcerated. Secondary deposits in the heart or its serous covering occurred in 2·3 per cent. Some degree of atheroma of the aorta was present in 31 per cent., but in only 7 per cent. was it extensive; and an aneurysm was only noted in two cases (·7 per cent.).

(*b*) **The Organs of Respiration.**—An excess of fluid (hydrothorax) in one or other pleural cavity was noted in 3 per cent. and a bilateral effusion in 6 per cent. of our cases. Acute pleurisy existed in 14 per cent., and was usually accompanied by a moderate amount of sero-fibrinous exudation, which in one seventh of the cases was distinctly blood-stained. This latter appearance was always associated either with metastatic deposits in the pleura or with a similar effusion in the abdomen. Suppurative pleurisy was never encountered, except when the

œsophagus was invaded by the cancerous disease. Adhesions between the base of the lung and the diaphragm existed in 16 per cent., and were almost twice as frequent on the right as on the left side. Secondary growths of the pleura occurred in about 4·5 per cent. of all cases; but this estimate does not include those in which the lymphatics were visibly distended with cancer juice (Hillairet). Obsolete tubercle was found in 16 per cent. of the cases, usually near the apex of the lung; but a recent extension of the disease was never observed. Emphysema was present in 28 per cent. The frequency of this condition has often been the subject of comment, and it is usually attributed to antecedent bronchitis. Careful inquiries, however, have convinced us that the subjects of gastric cancer rarely suffer from cough or shortness of breath prior to the onset of the gastric complaint. Moreover, it is significant that this variety of emphysema is always associated with atrophy of the heart, whereas in ordinary cases the right ventricle is invariably found to be enlarged. It is also noteworthy that the degree of emphysema is generally proportionate to the wasting of the soft tissues, and is most marked when the pyloric orifice of the stomach is stenosed. It is probable, therefore, that this form of emphysema is due to atrophy of the tissue of the walls of the lung, which deprives the alveoli of their natural elasticity and causes them to become dilated under the pressure of their contained air.

Acute pneumonia was noted in 6 per cent., and was usually lobular in its distribution and affected both lungs; but occasionally it occurred in the form of a grey hepatisation of one of the lower lobes. Signs of bronchitis and of œdema existed in every case where death was preceded by coma, while secondary growths were present in 7·6 per cent. of our cases.

(*c*) **The Spleen.**—The average weight of the spleen in our male cases was 5 oz., and in our female cases 4·2 oz. Since its normal weight varies up to 10 oz., it is obvious that the organ is considerably reduced in size in malignant disease of the stomach. The atrophy is most marked when the orifices of the stomach are the seat of the new growth. Thus, its average weight was 3·8 oz. when the cardiac orifice was affected, 6·2 oz. in disease of the body of the viscus, and 4·6 oz. when the pylorus was implicated. Infarction occurred in about 2 per cent. of the cases, and in 3·7 per cent. the organ was the seat of metastases.

(*d*) **The Liver.**—As the liver is especially liable to secondary growths, it was necessary to select only those cases in which its structure was normal in appearance. The average weight of the viscus in the males was 56 oz., and in the females 42 oz., and since its normal weight in the male varies from 50 to 69 oz., it is evident that the liver, unlike most of the other tissues of the body, undergoes little diminution in bulk during the course of gastric carcinoma. This anomaly is due partly to the engorgement of the portal system which accompanies a new growth in the stomach, and partly to the fatty infiltration of the hepatic structures which ensues in the majority of the cases. It is also possible that the constant absorption of deleterious substances resulting from disorganisation of the tumour acts as a stimulant to the hepatic cells. In support of this view it may be mentioned that the average weight of the liver was 55 oz. in our cases of pyloric stenosis, but that it amounted to 61 oz. when the body of the stomach was the seat of a soft and rapidly growing tumour. It is interesting to notice that only in one instance out of 265 cases (0·3 per cent.) was the organ affected with alcoholic cirrhosis.

(*e*) **The Kidneys.**—The average weight of these organs in our male cases was 11·1 oz., and in the female 9·5 oz. As the average normal weight in the former sex is 10 oz. and in the latter 8 oz., it will be seen that the kidneys usually increase in bulk. In addition to the signs of fatty degeneration of the renal epithelium, which are frequently met with, chronic interstitial nephritis was observed in 15·2 per cent. and chronic parenchymatous inflammation in 8 per cent. of our cases. Both varieties were exceptionally common in tumours of the body of the stomach, and apparently developed during the course of the gastric complaint, since neither albuminuria nor œdema was ever observed before the commencement of the fatal illness. These facts appear to indicate that, as a result of the retrograde changes that occur in the morbid growth, some organic substance is produced which is absorbed into the system, and during its subsequent elimination acts as an irritant to the renal tissue. Although up to the present time we have not succeeded in isolating such an ingredient of the urine, we are strongly of opinion that future researches in this direction will not only prove successful, but will afford considerable help in the diagnosis of gastric cancer. Hydro-

nephrosis occasionally results from the pressure upon a ureter of a peritoneal or subperitoneal growth, while in about 4 per cent. of all cases secondary deposits occur in one or both kidneys.

(*f*) **The Alimentary Canal.**—(1) *The Œsophagus.*—Stricture of the cardiac orifice is usually attended by slight dilatation of the lower third of the œsophagus and hypertrophy of its muscular coat. Invasion by the malignant growth occurs in about 46 per cent. of the cases of primary carcinoma in the cardiac half of the stomach, and not infrequently leads to perforation of the tube, with secondary inflammation of the left pleura or lung. Towards the end of life thrush is apt to extend downwards from the pharynx, and occasionally enlargement of the solitary glands or follicular ulceration is observed just above the cardiac orifice.

(2) *Stomach.*—Chronic gastritis almost invariably accompanies carcinoma of the stomach. At an early stage of the disease two varieties may be distinguished—the parenchymatous and the interstitial; but at a later period they usually coexist.

Chronic Parenchymatous Gastritis is most common in cases of soft spheroidal-celled and cylinder-celled growths of the body of the organ. To the naked eye the mucous membrane appears soft, swollen, and opaque, or exhibits a patchy form of congestion. On microscopical examination the superficial epithelium is found to be partially detached, and many of its cells are seen to be distended with mucus. The ducts of the glands are filled with granular and fatty cells of various sizes and shapes, with a few red blood-corpuscles and a considerable quantity of *débris*. The glands themselves are usually swollen, irregular in outline, and overlap one another. No lumen is visible, and no distinction can be made between central and parietal cells. At some parts of the section the tubules are completely filled with polygonal cells derived from the peptic cells; at others their contents consist principally of fatty detritus; while in advanced cases they appear shrivelled and empty and separated from one another by newly formed interstitial connective tissue. The vessels which ramify in the submucosa are dilated and engorged with blood, and there are usually signs of inflammatory exudation around the smaller arterioles on either side of the muscularis mucosæ. Occasionally groups or lines of cancer cells may be observed in the lymph spaces, even when the section has been made at some distance from the neoplasm.

Chronic Interstitial Gastritis invariably accompanies obstruction of the pylorus by a carcinomatous growth. In such cases the inner surface of the stomach exhibits after death a thick coating of tenacious mucus, and when this has been removed the mucous membrane presents an appearance of extreme congestion, with here and there a small hæmorrhage or a superficial ulcer. When examined by the microscope the section exhibits an irregular or distinctly villous surface, from hypertrophy of the connective tissue between the mouths of the ducts, and is almost denuded of epithelium. The ducts of the glands are twisted and distorted, and their lumina are often choked with mucus, detached cells, and *débris*. The glands themselves are separated from one another by strands of fibrous tissue, the thickness of which varies in different places. As the disease progresses the peptic cells of the cardiac region undergo secondary changes, which ultimately result in their detachment and disintegration; but in the pyloric end of the organ the comparatively long and tortuous tubules are not infrequently constricted by the new interstitial tissue. Under these circumstances the lower ends of the glands become dilated and form small cysts, which are lined by cubical epithelium and filled with mucus (retention cysts). Extension of the inflammatory process to the deeper structures destroys the muscularis mucosæ and produces partial fibrosis of the submucosa.

The fact that both varieties of inflammation, as well as a similar lesion of the intestine, are met with in cases of scirrhus of the mamma and other chronic carcinomata, renders it probable that they arise from the absorption of some deleterious material produced by the disintegration of the neoplasm, and are therefore allied to other toxæmic inflammations of the digestive tract.

(3) *Small Intestine.*—Invasion of the duodenum by continuity takes place in about 5 per cent. of the cases, but metastases are extremely rare. The jejunum is occasionally involved and its wall destroyed by a large growth of the pylorus.

(4) *Large Intestine.*—This portion of the intestinal tract is very liable to be attacked by chronic inflammation during the later stages of gastric carcinoma, and occasionally membranous colitis or ulceration is discovered after death. Metastases are chiefly met with in the rectum, but the transverse colon is often involved by a growth of the pylorus or greater curvature.

CHAPTER III

ETIOLOGY

1. Frequency

THE frequency of carcinoma of the stomach may be estimated either from data supplied by a large series of necropsies, from a study of the bills of mortality of different countries, or from the clinical statistics of various great hospitals. Each of these sources of information, however, presents so many chances of error that the results obtained from them must be regarded as strictly relative in their value. Necropsies are obviously the most reliable, in so far as the actual existence of the disease is concerned; but since only a certain proportion of hospital patients are examined after death, post-mortem records are apt to contain an excess of obscure or interesting cases, and consequently to exaggerate the frequency of all varieties of abdominal disease. Bills of mortality, although theoretically perfect from the fact that they represent all causes of death among all classes of the community, are based almost entirely upon the unverified diagnoses of a vast number of medical practitioners of varying knowledge and experience, and are therefore always open to grave suspicion.[1] Finally, clinical statistics from the hospitals of London, while they undoubtedly represent an excellent average of diagnosis, are concerned entirely with the poorer classes of an urban population, and consequently lack the most essential feature of the statistics of mortality.

[1] In this connection it may be mentioned that out of fifty-six cases admitted under our care into hospitals with a diagnosis of cancer of the stomach, thirty-one, or 55·3 per cent., were proved to be suffering from that complaint, while the remaining 44 7 per cent., were free from the disease. The average duration of the illness at the time of admission was nearly four months.

A. POST-MORTEM STATISTICS

Out of 8,468 necropsies collected principally from British hospitals, Brinton found cancer of the stomach recorded in eighty-one, or in about 1 per cent.; while 14,974 performed at the London and London Temperance Hospitals between 1880 and 1896 included 239 examples of the disease (1·6 per cent.). In Paris, between 1861 and 1863 the proportion of deaths from the complaint in every hundred deaths was 1·9. In Berlin, the post-mortem statistics of Hahn and Guttmann present a ratio of 2·9; in Vienna the figure would appear to be 1·5, in Prague 3·5, in Helsingfors 4, and in Copenhagen 9. The excessive frequency of the disease in the last-named city may be explained to some extent by the advanced age of most of the patients admitted to the hospitals, but it is interesting to remember that Copenhagen is also celebrated for the prevalence of gastric ulcer (Dahlerup).

TABLE 9.—POST-MORTEM STATISTICS

City	Author	No. of necropsies	No. of gastric cancers	Percentage
London	Fenwick	14,974	239	1·6
Paris	Salle	22,503	440	1·9
Berlin	Hahn and Guttmann	8,522	247	2·9
Vienna	Gussenbauer and Winiwarter	61,287	903	1·47
Prague	Welch	11,175	393	3·5
Helsingfors	Holsti	3,775	152	4·0
Copenhagen	Grünfeld	1,150	102	9·0

B. BILLS OF MORTALITY

Our knowledge derived from this source is very imperfect, since most of the registration returns refer to carcinoma generally rather than to its relative incidence upon different viscera. The material at hand, however, appears to point to the same conclusion as that deduced from the study of post-mortem statistics, namely, that the complaint varies greatly in frequency in different parts of the world. Thus, in Paris (1830–1840) Tanchou estimated the frequency of gastric cancer as compared with that of all causes of death at 0·6 per cent.; in Vienna it is stated to be about 0·8 per cent., in Hamburg 1·25 per cent., in Zurich (1872–1874) 2 per cent., in Geneva (1855) 2·5 per cent., in Würzburg (1852–1855) 1·9 per cent., and in New York (1868–1882) 0·4 per cent.

C. CLINICAL STATISTICS

These have been collected from the official reports of six general hospitals in London, and extend over a period of ten years or more. Their chief value lies in the fact that they probably represent the best average of diagnosis that it is possible to obtain; while the large number of cases dealt with in each instance, and the wide area from which they were drawn, help to reduce the margin of error to a comparatively small compass. The following table shows the results obtained from each hospital, and also affords a contrast with similar statistics, derived from two important institutions in the United States and one in Canada, which cover the same period of time.

TABLE 10

Hospital	Period	Medical admissions	Gastric cancers (diagnosed)	Percentage	Proportion of deaths from gastric cancer per 100 medical deaths	
					At all ages	Over 20 years
The London	1890–1899	47,169	236	0·5	1·4	3·1
St. Bartholomew's	1887–1899	30,868	146	0·47	1·7	
St. Thomas's	1887–1899	24,600	139	0·56	1·4	
Westminster	1884–1900	18,175	92	0·5	1·2	
London Temperance	1890–1899	4,643	20	0·43	1·5	
University College	1882–1890	11,006	69	0·62	1·3	—
Johns Hopkins	1889–1898	8,464	150	1·7	—	—
Massachusetts	1889–1897	11,812	129	1·0	—	—
Montreal	1889–1897	9,458	54	0·57	—	—

A careful examination of these figures brings to light several interesting and important facts. In the first place, it will be observed that, in spite of the varying numbers of patients who were admitted into the different hospitals of London, the percentage frequency of carcinoma of the stomach as diagnosed in the wards is practically the same in every instance, and represents about 0·5 per cent. of all the medical admissions. Secondly, the proportional death-rate from the disease is also almost identical in each institution, namely, 1·4 per cent. of all the medical deaths. Thirdly, if the fatal cases in the medical wards are analysed according to age, it is found that for every 100 persons who died after the age of twenty years, 3·1 succumbed to carcinoma of the stomach. Finally, it is

worthy of notice that the complaint was responsible for 13·1 per cent. of all the deaths which resulted from diseases of the digestive organs.[1]

The Relative Liability of different Organs.—Much discussion has taken place regarding the liability of the stomach to carcinoma as compared with that of the other organs of the body. Brinton considered that the gastric lesion constituted about 33 per cent. of all primary cancers; Virchow estimated it at 34·9 per cent.; d'Espine at 44·37 per cent.; Tanchou at 25·2 per cent.; Salle at 31·9 per cent.; Welch at 25·7 per cent.; Häberlin at 41·5 per cent.; Holsti at 53·9 per cent.; Eisenhart at 18·92 per cent.; Reiche at 35·5 per cent.; and Riegel at 50 per cent. Out of 3,011 [2] primary carcinomata the diagnoses of which were verified after death, the stomach was the seat of the growth in 1,006, or in 33·4 per cent., and the uterus in 984, or in 32·6 per cent.; while among 43,894 *unverified* cases included in various bills of mortality, 10,442, or 23·7 per cent., presented disease of the stomach, and 8,900, or 20·2 per cent., of the uterus. It is worthy of notice that the relative liability of the two organs seems to vary considerably in different places. Thus, in England the ratio of gastric to uterine carcinoma is about 7 : 6; in Hamburg, nearly 2 : 1; in Berlin, 7 : 5; in Prague, 7 : 6; in Würzburg, 7 : 4; in Helsingfors, 7 : 1, and in Geneva, 3 : 1. In New York and Paris and in Australia the two organs are said to be equally affected, while in Vienna the uterus is apparently more frequently diseased than the stomach. Two conclusions may be drawn from these facts: (1) That at least 50 per cent. of all primary carcinomata develop either in the stomach or in the uterus; (2) that while the uterus is relatively more often affected, since it is a viscus of one sex only, the stomach is absolutely the most frequent seat of the disease, and its lesion constitutes 30–35 per cent., or about one-third, of all primary carcinomata.

The Increase of the Disease.—That the death-rate from carcinoma generally is steadily increasing in almost every part of the civilised world hardly admits of doubt. In the report of

[1] These include the various diseases of the œsophagus, stomach, intestines, liver, pancreas, and peritoneum which were treated in the medical wards. The figures were too complex to insert in the table.

[2] The post-mortem material was derived from the records of hospitals in London, Paris, Berlin, and Prague, and the mortuary statistics from England (1899), Paris, New York, Geneva, Würzburg, and Frankfort-on-Main.

the Registrar-General for England for 1896, the statistics bearing upon this question are arranged in groups of five years, from 1861 to 1895 inclusive, and show the following death-rate from cancer per 100,000 living.

TABLE 11

Date	1861-1865	1866-1870	1871-1875	1876-1880	1881-1885	1886-1890
Death-rate . .	36·78	40·38	44·56	49·36	54·76	63·16
Date	1891-1895	1896	1897	1898	1899	1900[1]
Death-rate . .	71·22	76·4	78·3	79·8	82·5	82·8

In 1896 the death-rate per 100,000 living was 76·4, in 1897 78·3, in 1898 79·8, and in 1900 82·8. In other words, during the last thirty years the death-rate from this cause has been nearly doubled. J. D. Bryant, of New York, has shown that the disease is constantly on the increase in the United States, and that the mortality from it has been trebled between 1860 and 1890.

According to Kirchner, the death-rate from cancer in Prussia per 10,000 living had risen from 3·73 to 5·29 in the case of men, and from 4·45 to 6·03 in the case of women, during the period 1888 to 1897. Hirschberg's statistics for Berlin show an increase in the mortality from the disease per million living from 657 men and 1,126 women in 1876 to 1,537 men and 1,775 women in 1895.

In Australia, Mullins found that the death-rate from cancer had been trebled between 1857 and 1893; while in New Zealand, Macdonald states that it was twice as great in 1889 as in 1879.

The fact that until quite recently it was the custom in official returns to consider malignant disease in its entirety rather than as regards the organ that was primarily affected, renders it difficult to offer much statistical evidence as to the increase or otherwise of the gastric lesion. Häberlin was the first to point out that in Switzerland the frequency of gastric carcinoma is constantly increasing, and compiled the following table, which

[1] The rates 1897-1900 have been corrected by the new census returns.

shows the death-rate from the disease per 1,000 inhabitants of that country from 1877 to 1886.

TABLE 12

Date .	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886
Death-rate .	0·61	0·66	0·72	0·77	0·85	0·87	0·85	0·84	0·90	0·99

In the report of the Registrar-General for England for 1889 figures are given for certain areas in 1868 and 1888 respectively. The death-rate per million living of thirty-five years and upwards from cancer of the stomach was, in 1868, males 283·65, females 193·45. In 1888 it had risen to 346·15 in men and 277·75 in women. In other words, there was an increase of 22 per cent. in males and 44 per cent. in females.

According to the census returns of the United States for 1880, in certain groups, among 1,000 deaths from cancer where the seat of the disease was known there were 300·18 from cancer of the stomach. The total deaths from this cause were 2,133, which, in a population for the area of about 29,000,000, gives one death from the disease in every 13,595 living. In 1890 certain areas gave a rate of one death to every 9,761 living (Osler and McCrae).

Both in Hamburg and Helsingfors, and more especially in the latter town, the death-rate from the disease has greatly increased during the last twenty years (Reiche, Holsti).

From the following figures, supplied to us by Dr. Tatham, it will be seen that the death-rate from the disease in England has only slightly increased in both sexes during the last few years.

TABLE 13.—MORTALITY FROM CARCINOMA OF THE STOMACH PER MILLION LIVING (ENGLAND AND WALES)

Year	Males	Females
1897	130	123
1898	139	123
1899	137	128
1900	138	135

We have also collected statistics from three of the largest hospitals of London for two periods of five years each, the first

being 1881 to 1885, and the second 1895 to 1899. The results, which are expressed in the following table, show that the percentage frequency of gastric carcinoma in the medical wards increased from 0·4 to 0·6, and the proportional death-rate from the disease from 1·42 to 1·82 per cent. in the course of fifteen years. It must be borne in mind, however, that the rapid advance that has taken place in abdominal surgery since 1885 has caused many cases to be transferred from the medical to the surgical wards, and at the same time has probably induced a larger number to seek hospital treatment; and since it is impossible to calculate the relative influence of these two factors, no absolute conclusion can be drawn from the figures.

TABLE 14

Period	Total medical admissions	Gastric cancers (diagnosed)	Percentage	Proportional death-rate per 100 medical deaths
1881–1885	39,011	159	0·4	1·42
1895–1899	46,025	279	0·6	1·82

Newsholme and King consider that the increase of cancer is more apparent than real, and may be explained by the better methods of diagnosis that are now in vogue. For our own part, however, we believe that every advance which is made in practical medicine is more likely to diminish than to increase the apparent death-rate from carcinoma of the stomach. Thus, a medical man whose knowledge is deficient usually regards a fatal complaint accompanied by indigestion, vomiting, and loss of flesh, as cancer of the stomach; whereas another, who is better versed in the science of diagnosis, will often discover that the symptoms are due to simple ulcer, kidney disease, stricture of the bowel, phthisis, or to a tumour of the brain.[1] Again, it was formerly the custom to regard carcinoma as the principal cause of pyloric stenosis, and in the absence of a necropsy almost every case which presented signs of dilatation of the stomach was recorded as 'cancer.' At the present time, however, it is universally recognised that the cicatricial contraction of a simple ulcer or adhesions to the gall-bladder are responsible for a large proportion of all strictures of the pylorus, and that the modern methods of diagnosis permit them to be distinguished from the malignant variety during life. Finally,

[1] See footnote, p. 78.

the more ignorant the practitioner, the greater is the probability that he will regard all palpable tumours of the abdomen as 'cancerous;' while the better his education, the more readily will he differentiate between visceral enlargements and true tumours, and between the malignant and benign varieties of the latter. For these several reasons we are strongly of opinion that with the growth of medical education the apparent mortality from abdominal carcinoma will exhibit a slower rate of increase than is observed in the case of the so-called 'accessible organs.'

2. Sex

It was formerly the custom to regard the disease as especially common in men, and the statement of Brinton, that it is twice as frequent in males as in females, was for a long time regarded as indisputable. More extensive observations, however, have shown that the data which formed the basis of that author's researches were insufficient to warrant many of the conclusions which he drew from them. Thus, Fox found that in his series of 1,303 cases the sexes were almost equally represented (680 : 623), while in the 2,214 analysed by Welch, nearly all of which had been verified by necropsy, there were 1,233 males and 981 females, a ratio of 5 to 4. With the aid of recent statistics we find that out of a total of 3,679 post-mortem examinations of gastric cancer, 2,162 were males and 1,517 females, which gives a proportion of rather less than 6 to 4.[1]

Clinical records afford somewhat similar results, for out of 130,000 persons admitted into the medical wards of hospitals in London, we find that ·6 per cent. of the males and ·4 per cent. of the females were considered to be suffering from malignant disease of the stomach. Both these sets of figures, however, probably exaggerate the frequency of the complaint in men, since all post-mortem statistics present an excess of males, while the medical admissions of women into hospitals include not only a considerable number of obstetric cases, but also an undue proportion of minor ailments.

The bills of mortality of certain great cities seem to indicate that very little difference exists in the liability of the two sexes.

[1] These figures include those of Dittrich, Wrany, Eppinger, Brinton, Virchow, Lebert, Leudet, Katzenellenbogen, Lange, Habershon, Gussenbauer and v. Winiwarter, Hahn, Salle, Guttmann, Holsti, Martin, Perry and Shaw, and those derived from the London, the London Temperance, and the Munich Hospitals.

Dr. Tatham informs us that in England and Wales, during the four years 1897–1900, the deaths from malignant disease of the stomach comprised 8,369 males and 8,355 females. Ledoux-Lebard states that in Vienna the incidence of the complaint is practically equal in the two sexes. Welch came to a similar conclusion after an exhaustive study of the records of the Board of Health for New York; while in Hamburg, Reiche found that out of every hundred deaths in each sex, 1·3 of the males and 1·1 of the females died from cancer of the stomach. It may therefore be concluded that although men may be slightly more often affected by the disease than women, the difference is too insignificant to merit special consideration.

With regard to the influence of sex upon the situation of the growth there is very little to be said; but from our own cases it would appear that stenosis of the pylorus is rather more common in women than in men, while the reverse is the case as regards disease of the body of the stomach.

3. Age

Carcinoma of the stomach may be said to be a disease of maturity. Scheffer found that only 2 per cent. of the cases which he collected were less than thirty years of age; Brautigam's estimate, made on similar lines, was 2·5 per cent., Reichert's 3 per cent., while our results indicate a ratio of 2·5 per cent. In the following table we have arranged 2,604 fatal cases (necropsies) according to the age of each individual at the time of death, and in the next one 882 cases which were diagnosed at various hospitals in London.

TABLE 15.—AN ANALYSIS OF 2,604 NECROPSIES UPON GASTRIC CARCINOMA, SHOWING THE AGE AT THE TIME OF DEATH

Age	No. of cases	Percentage	
Under ten	—	—	
Ten to twenty	4	·15	
Twenty to thirty	64	2·4	
Thirty to forty	357	13·7	
Forty to fifty	660	25·3	
Fifty to sixty	777	29·8	= 77·0
Sixty to seventy	570	21·9	
Seventy to eighty	149	5·7	
Eighty to ninety	20	0·76	
Over ninety	3	0·11	
Total	2,604	100	

TABLE 16.—AN ANALYSIS OF 882 CLINICAL CASES, SHOWING THE AGE AT THE TIME OF DEATH

Age	No. of cases	Percentage	
Under ten	—	—	
Ten to twenty	3	0·34	
Twenty to thirty	29	3·3	
Thirty to forty	126	14·3	
Forty to fifty	262	29·7	80·6
Fifty to sixty	291	33	
Sixty to seventy	158	17·9	
Seventy to eighty	13	1·47	
Eighty to ninety	—	—	
Over ninety	—	—	
Total	882	100	

It will be observed that in the main the results expressed in the two tables are in accord with one another. In both the greatest number of cases in any decade occurs between fifty and sixty; while the aggregate between forty and seventy amounts in each instance to about 80 per cent. of the whole. On the other hand, the series of necropsies which were collected from different cities of Europe present a greater proportion of cases over seventy years of age than do the clinical figures from London. This is readily explained by the fact that in London the aged poor who are afflicted with incurable diseases are more often admitted to workhouse infirmaries than into general hospitals, while in other countries this distinction is not observed.

These two sets of figures, although of interest in their own way, merely indicate the period of life at which the majority of the cases of gastric carcinoma come under medical observation, and obviously afford no evidence as to the relative liability of the population to the complaint at different periods of life. We have therefore appended the following tables, which have been compiled for us by Dr. Tatham.

In the first table, which refers solely to cases met with in hospital practice, the maximum liability to the complaint appears to occur between fifty-five and sixty-five years of age, and thus corroborates the evidence obtained from the post-mortem and clinical statistics previously quoted. When, however, the deaths from carcinoma of the stomach occurring in the whole county of London are taken into consideration, it at once becomes evident that the disease increases in frequency up to

TABLE 17.—DEATH-RATE FROM CANCER OF THE STOMACH (FATAL CASES IN LONDON HOSPITALS)

Ages . .	Under 25	25–35	35–45	45–55	55–65	65–75	75 and upwards
Population .	2,281,861	810,688	592,166	414,296	260,173	133,022	52,777
Cases . .	3	19	73	82	61	22	1
Rate (per million)	**1**	**23**	**123**	**198**	**234**	**165**	**19**
Percentage to No. at all ages .	1·1	7·3	28·0	31·4	23·4	8·4	0·4

TABLE 18.—DEATH-RATE FROM CANCER OF THE STOMACH (REGISTRATION RETURNS FOR LONDON, 1901)

Ages	Under 25	25–35	35–45	45–55	55–65	65–75	Over 75
Population (Male and Female) . .	2,281,861	810,688	592,166	414,296	260,173	133,022	52,777
Deaths (Cancer of Stomach) . .	1	13	60	131	164	137	47
Rate (per million) . . .	**—**	**16**	**101**	**316**	**630**	**1,030**	**891**
Percentage of deaths at specified ages to deaths at all ages .	0·2	2·4	10·8	23·7	29·6	24·8	8·5

seventy-five years of age, and that the maximum liability really occurs between sixty-five and seventy-five. The fallacies inherent in hospital statistics regarding the influence of sex in disease have already been noted, and it now becomes evident that, owing to the infrequent admission of old persons into general hospitals, the effect of age has also been misjudged. We therefore conclude that, contrary to the usual teaching, the tendency to gastric carcinoma steadily increases with each decade of life until about the age of seventy-five.

It was formerly believed that carcinoma never attacked the stomach before puberty, but there is now sufficient evidence to prove that the disease does occasionally develop during childhood. Six cases have been reported in children less than ten years of age, but in most of them the details given of the necropsy are hardly conclusive as to the existence of primary cancer of the stomach. Thus, the one recorded by Williamson in 1841 was almost certainly an example of hypertrophic stenosis of the pylorus; while in those related by Kaulich and

Widerhofer both the nature of the growth and its primary location are very doubtful. Kuhn's case would appear to have been an example of lymphosarcoma.

In 1877 Cullingworth published the case of an infant who commenced to vomit on the tenth day after birth, and died of exhaustion in the sixth week. The necropsy showed a soft pedunculated tumour, which had almost occluded the pyloric orifice and given rise to great dilatation of the stomach. On microscopical examination the growth was found to possess the structure of a cylinder-celled carcinoma, and as an example of such it has always been quoted, although it seems to us that the possibility of a congenital adenoma has never been duly considered. Ashby and Wright's case was a child eight years of age who presented an abdominal tumour during life. After death considerable dilatation of the stomach was found, along with an ulcerated cylinder-celled carcinomatous ulcer of the duodenum and two growths the size of peas on the cardiac side of the pylorus.

Between ten and twenty years of age the complaint is less infrequent, although, of the sixteen cases which are said to have occurred at this period, at least four appear to have been examples of lymphosarcoma. In this category we would include the case of a boy who came under our notice for pain in the abdomen, vomiting, and emaciation. The epigastrium and umbilical region were occupied by a hard tender swelling, which moved slightly with respiration and rapidly increased in size. After death, which occurred in three months, the stomach and duodenum were found to be infiltrated with a soft growth, which had produced metastases in the mesenteric glands and peritoneum. Although the disease was supposed to be encephaloid cancer, microscopical examination left little doubt that it was really lymphosarcoma.

After the age of twenty the disease increases in frequency, and the cases that occur during the third decade comprise 2·4 per cent. of those at all ages.

Sex appears to exert little influence upon the period of life at which the disease commences, since between thirty-five and seventy-five years of age its proportional incidence in males and females is practically identical in each decade. It is interesting to notice, however, that the precocious development of gastric cancer is far more common in males than in females, for

out of twenty-five cases occurring before the age of thirty which we have collected from different sources, no fewer than twenty-one were of the former sex, a ratio of more than 5 to 1. As far as our researches go, spheroidal-celled carcinoma appears to be more frequent in the young than the cylinder-celled variety, and colloid changes are relatively more common.

4. Geographical Distribution

The chief difficulty of determining the relative frequency of carcinoma in different parts of the globe is due to the extraordinary deficiency of trustworthy observations. In many instances our sole information upon the subject is derived from the general impressions of some explorer more or less versed in medical matters, while in not a few cases dogmatic inferences have been drawn from the experiences of a single individual extending over a very limited period. Thus it is the custom to state that cancer of the stomach is very rare in Vera Cruz, because Heinemann happened to see only one example of the complaint during a residence of six years in that city; while its supposititious infrequency in Japan has been founded upon the equally limited experience of Schulze. When one considers how many medical men in the rural districts of England, and even in London, must fail to meet with a case of gastric cancer during the first six years of practice, it appears almost incredible that such worthless statements should ever have been regarded as worthy of notice.

As far as our present knowledge extends, carcinoma may be said to exist among all the civilised nations of the globe. In Great Britain, France, Spain, Germany, Austria, Italy, Russia, and Norway, it is not only rife but increasing in frequency. In Denmark it appears to be especially prevalent, and the same remark applies in a lesser degree to Switzerland. In Turkey and Greece it is said to be less common (Rigler, Röser), while in Iceland it is described as rare (Finsen). Speaking generally, Continental statistics indicate a much greater frequency of gastric carcinoma than those of Great Britain. The United States and Canada exhibit an ever-increasing mortality from cancer, and there is evidence to show that it is by no means infrequent in South America (Rey, Gayraud and Domec, Jourdanet).

Northern Africa, including Egypt, Tunis, Algiers, and Abyssinia, is supposed to enjoy a special immunity from the complaint; but south of the Zambesi it is stated by competent authorities to be extremely frequent. Syria, Persia, and Arabia, like other countries where accurate observations are lacking, are said to be comparatively free from cancerous diseases (Polak, Palgrave), while in most parts of India the reverse is the case. According to Hobson, carcinoma in all its forms is frequently met with in China; but medical missionaries who have travelled in the interior of that country have assured us that cancer of the stomach is very rare.[1] Its prevalence in Australia and New Zealand has already been commented upon.

5. Topography

Moore was the first to point out that carcinoma is more prevalent in the southern and eastern parts of England than in the northern and western districts; and that if a line be drawn across the country from Bristol to Peterborough, the cancer mortality will be found to be much greater to the south than to the north of that boundary. At the present time the counties which present the highest death-rates from the disease are London, Cambridge, Huntingdon, Northampton, Sussex, Warwick, Bedford, Surrey, and Middlesex; while those with the lowest are Derby, Bucks, Herts, Durham, Cornwall, Monmouth, Dorset, Lancaster, and parts of South Wales. These topographical variations in the cancer mortality would appear from estimates made by the Registrar-General to be independent of sex and age distribution. Another interesting fact that has been brought to light by investigations of this nature is that the death-rate from the disease is greater among rural than industrial populations, the inhabitants of country towns like Chichester, Canterbury, Huntingdon, and Cambridge being more affected than those of the great industrial cities. Haviland asserted that the highest cancer mortality is met with in low-lying districts which are traversed by sluggish streams and are liable to periodic inundations, and in support of this view he instanced the Thames and its tributaries, which run through districts that are markedly cancerous. That there is probably

[1] A similar statement made by Cantlie of Hong Kong is cited by Roger Williams.

a good deal of truth in this contention is shown by the following remarks of the Registrar-General in his report for 1890 :—

'Crude death-rates show that in and around Huntingdonshire and Cambridgeshire there is a well-defined area in which cancer is exceptionally prevalent. It comprises the districts of Stamford, Bourn, Spalding, and Holbeach in Lincolnshire, Oundle and Peterborough in Northamptonshire, and most of the counties of Huntingdon and Cambridge. In 1881–1890 this area had a mean population of over 300,000, its crude cancer-rate being 859 per million, or 46 per cent. above the average for the country in general; in the preceding decennium the excess was 44 per cent.' On the other hand, as Roger Williams has pointed out, many islands that have no rivers, that are not low-lying and are not of alluvial formation, such as the Scilly, the Channel Islands, and the Isle of Wight, have nevertheless a very high cancer mortality. In Norway also cancer occurs for the most part in the mountainous districts and at considerable elevations; while in Mexico the high table-land is more subject to the disease than the low-lying plains (Hirsch). It follows, therefore, that whatever influence a special district may exert upon the development of cancer, geological configuration is by no means the sole factor in its production.

It has frequently been noticed that the inmates of certain houses are especially liable to carcinoma, which appears among successive tenants who are neither related to one another nor possess any hereditary predisposition to the disease (Arnaudet, Fabre, Webb, Fiessinger). In Webb's case a man died of cancer of the rectum in a certain house at the age of twenty-six. Of the next tenants, the husband died of gastric cancer and the wife of cancer of the rectum; while of the three ladies who next inhabited the house, one died from malignant disease of the stomach and another from a similar affection of the uterus. Mason has also shown that in the district of Leamington the disease is quite common in houses situated in certain rows or upon one side of a row, while in other streets it is conspicuous by its absence. This writer has also remarked that about 17 per cent. of these cancer houses were placed at the end or at the corner of a street, were of old construction, and were built upon a porous subsoil. In this connection it may be noted that both husband and wife not infrequently fall victims

to carcinoma of the digestive organs if the survivor continues to reside in the same house, while occasionally the disease occurs almost simultaneously in both. Thus we have known a man to be attacked by cancer of the stomach while his wife was dying from a similar affection of the duodenum; and also a man and his two daughters to develop malignant disease of the stomach or colon within a period of twelve months. These several phenomena occur too frequently to be regarded as mere coincidences, and probably depend upon the operation of some well-defined local cause, the nature of which, however, is still obscure.

6. Race

Want of evidence renders it difficult to determine the exact influence of race upon the inception of the disease, but all the information we possess seems to indicate that savage peoples enjoy a comparative immunity. In Central Africa the negroes appear to be seldom affected, while in the southern portion of that continent the coloured inhabitants rarely fall victims to the disease, which, however, is very rife among the white population and the crossbreeds. Landry found cancer to be rare among the aborigines of Canada, and it is also said to be infrequent among those of New Zealand. According to the Tenth Census Report of the United States, the cancer death-rate was 27·96 per 100,000 *whites* and 12·17 per 100,000 *blacks*.

In India both Mohammedans and Hindoos are equally affected, while among the Chinese superficial carcinomata are common, but the gastric lesion is comparatively rare. It is interesting to observe that in civilised countries the aliens usually suffer more from malignant growths than those born in the country. Thus, among the entire population of Australia over twenty-one years of age, Mullins found that the death-rate from cancer of those born in Germany was one in 538, of those born in the United Kingdom one in 748, and of those born in Australia one in 2,738. From these and other similar facts he concluded that about three-fourths of the total mortality from the disease was borne by the immigrant population. The researches of Osler and McCrae at the Johns Hopkins Hospital point to a similar conclusion, for they found that the native-born, who constituted 78·3 per cent. of the patients, supplied only 57·3 per cent. of the cases of gastric cancer, while the foreign-

born element, which formed only 21·7 per cent. of the patients, contributed no less than 42·7 per cent. of the cases of that disease. They also draw attention to the fact that, according to the census of 1880, the death-rate from cancer per 100,000 living was 20·08 for the native-born and 53·3 for the foreign-born. Finally, they make the interesting statement that 'a lower death-rate (from carcinoma of the stomach) is found in children of mothers born in the United States, the highest being in those of mothers born in Germany. This is most marked in the cases over sixty-five years of age, being 42·72 in children of native-born mothers and 123·62 in the children of mothers born in Germany.'

It has been asserted, although upon what authority we have been unable to discover, that the Jews are seldom affected by gastric cancer. Our own experience has convinced us that far from being comparatively immune, the Jewish race is particularly prone both to cancer and to simple ulcer of the stomach; while according to Billings the death-rate from cancer among the Jews of the United States is the same as that of the rest of the white population.

7. Heredity

Statistical inquiries relative to an hereditary predisposition to cancer have shown that in 13·22 per cent. of all cases of the disease some relative of the patient had died from a malignant growth. With regard to carcinoma of the stomach, Lebert found a family history of cancer in 7 per cent. of his cases, Häberlin in 8 per cent., Bräutigam in 12 per cent., Schüle in 6·5 per cent., and Osler and McCrae in 7·3 per cent. In our own series, one or other parent had died of cancer in 6 per cent., and a brother or sister in 2 per cent. It must be remembered, however, that all these figures relate to hospital patients, the majority of whom are profoundly ignorant of their family history. In private practice a cancerous history is obtained in about 16 per cent. The mere fact that a patient with gastric carcinoma was related to some one who died of cancer has little bearing upon the question of the hereditability of the disease, since one in every twenty-one men and one in every twelve women who attain the age of thirty-five die of some malignant affection. What is of importance is the occurrence of carcinoma of the same organ in successive generations. This homotypic transmission of the complaint has so often been

pointed out that a few examples will suffice to illustrate it. In the Bonaparte family, Napoleon the First, his father, his brother Lucien, and two of his sisters, Caroline and Pauline, all died of carcinoma of the stomach. Manichow has recorded that twenty-three families resident in one district had sixty-nine cancerous members between them, of whom fifty-seven died of gastric cancer and four others of malignant growths of the intestine or liver. Among our own cases, the gastric complaint appeared in one instance in three generations, while in another three brothers, their father and a sister, all succumbed to it. It is interesting to observe that the predisposition is usually most marked in children of the same sex as the cancerous parent. Thus, if the mother is affected, the daughters will exhibit the greatest liability, while in the case of a cancerous father it is the male issue that are principally attacked. It is often stated that a family predisposition to cancer favours its precocious development; but we are personally of opinion that the gastric disease has a curious tendency to appear at the same age in each generation, and that the popular superstition upon this point has, consequently, a solid groundwork of fact. It is occasionally observed that the tendency to the disease is transmitted through some member of the family who had personally escaped. Thus we find it appearing in several members of a family whose uncles, aunts, and perhaps grandparents, had been affected in a similar manner, while the parent had lived to a great age. Less frequently a grandparent will transmit the disease to grandchildren, while all the immediate offspring remain free from cancer. In 18 per cent. of our cases one or both parents were stated to have died at a very advanced age, and in several instances the grandparents had also exceeded the usual span of life. This curious longevity among the progenitors of cancerous families has often been the subject of comment (Roger Williams), and serves to emphasise the fact that malignant disease is particularly apt to attack those who are considered to be constitutionally healthy. Lastly, it may be noted that persons who die from gastric cancer are often endowed with great reproductive fecundity, and are themselves members of large families. In our series the average number of children was 6·6, whereas in the general community the average number of a family is 4·6 (Farr). Conversely, it is rare to find an only child attacked by carcinoma of the stomach.

8. Occupation

The most careful inquiries have failed to show that occupation exercises any material influence upon the development of gastric carcinoma, while the fact that married women suffer from the complaint equally with men seems to point to a similar conclusion. The following table, which is taken from the Fifty-fifth Annual Report of the Registrar-General of England, indicates the relative incidence of cancer in males engaged in different forms of employment, but since the primary seat of the disease is not specified its conclusions are not entirely relevant to the gastric lesion.

TABLE 19.—CANCER DEATHS IN MALES. HIGHEST AND LOWEST MORTALITY FOR CERTAIN OCCUPATIONS, SHOWING THE COMPARATIVE FIGURE TO 1,000 DEATHS FROM ALL CAUSES (ENGLAND)[1]

Above the average [47 per mil.] Occupations	Comparative figure	Below the average [47 per mil.] Occupations	Comparative figure
Chimney-sweeps	156	Medical profession	43
Copper-miners	86	Miners, all classes	37
Brewers	70	Farmers	36
Innkeepers (London)	70	Agricultural labourers	36
Inn servants	67	Gardeners	36
Commercial travellers	63	Coalminers	36
Plasterers	62	Clergymen	35
Barristers and solicitors	60	Potters	35
Merchant seamen	60	Grocers	34
Innkeepers (industrial districts)	58	Hosiery-makers	30
Milk-sellers	58	Lace-makers	28
General labourers (London)	58	Lead-workers	27
Butchers	57	Coalminers (S. Wales)	26
		Paper-makers	22
Occupied males (London)	59	All occupied males	44
Occupied males (industrial districts)	48	All occupied males (agricultural districts)	40

9. Diet

The inordinate frequency with which carcinoma attacks the alimentary canal naturally suggests that the infective agent, if such there be, is usually introduced into the

[1] In this table the mortality of all males from twenty-five to sixty-five years of age from all causes is taken as a standard = 1,000. Out of this number the deaths from cancer in all males amount to forty-seven. The table gives the comparative numbers for males in different occupations, these numbers having only a *relative*, and not an absolute, value.

body with the food. It is therefore necessary to inquire whether indulgence in or abstinence from some particular article of diet exerts any decided influence upon its development. Reclus and others appear to have convinced themselves that those who live upon vegetables are practically exempt from the disease, but the evidence upon which this belief is founded is somewhat obscure. On the other hand, there are strong reasons for believing that the exclusive use of vegetables does not prevent the inception of cancer. Hendley states that out of 102 patients who were operated upon for carcinoma at Jeypore between 1880 and 1888, sixty-one were lifelong vegetarians; while nearly 3 per cent. of our cases of gastric carcinoma denied that they had eaten meat for many years. In private practice we have also frequently observed the disease in people who had long abstained from animal food. The popular superstition that tomatoes give rise to cancer is probably founded upon some fancied resemblance between the interior of the vegetable and a fungoid growth. Other authorities attribute the increase of carcinoma to the greater consumption of meat by the population during the last half-century. It can hardly be denied that the tendency to luxurious living has increased in almost every country in the last fifty years, but that excessive indulgence in meat is a primary factor in the production of the disease has yet to be proved. It may be noted that the liability to cancer of the stomach increases with age, whereas the appetite for meat usually diminishes after middle life. Moreover, it is almost unknown among savage tribes, who live by hunting, and among the Esquimaux, while it is common both in hospitals and infirmaries, whose sick inmates have seldom enjoyed opportunities for over-indulgence in meat.

Again, there is no evidence to show that any special variety of animal food promotes the development of the complaint. Dried and tinned foods are apparently harmless, and Bauby has shown that pork-eaters are not more prone to the disease than others. It has been suggested that the importation of frozen mutton might be responsible for the increasing prevalence of malignant disease in Europe; but the comparative immunity enjoyed by the native populations of Australia and Argentina, and the uniform increase of the disease in all parts of the civilised world, are sufficient to negative this supposition.

Fishermen in England are unduly prone to cancer, but this can hardly be ascribed to their diet, since the disease is very common in the Black Forest and other parts of Central Europe where fish is a rare article of food.

It is often asserted that teetotalers are seldom affected by carcinoma, but we are not aware of any authentic evidence in support of this view. On the contrary, we find that nearly 40 per cent. of our cases at the London Temperance Hospital were total abstainers; while at the London Hospital, where patients are very seldom given to abstinence, no less than 4 per cent. of the cases of gastric cancer affirmed that they had been lifelong abstainers from alcohol. It may also be noted that malignant disease is very common among the Mohammedan population of India, who never indulge in alcohol; while the British Medical Association's report upon the etiology of cancer indicates that the alcoholic habit is, if anything, antagonistic to the development of carcinoma. Lastly, Roger Williams has laid great stress upon the tendency of the complaint to attack people who have led sober and industrious lives, and upon the comparative immunity of those of debauched and dissolute habits. We are also convinced that the gastric lesion is extremely rare among persons affected with alcoholic gastritis, cirrhosis of the liver, and nervous complaints due to chronic alcoholism. Although, therefore, it is possible that the abuse of stimulants may so diminish the natural resistance of the tissues as to favour the inception of cancer, as it undoubtedly does that of tubercle, we do not believe that it is in any way an important factor. Cloquet has attributed the prevalence of cancer of the stomach in certain parts of Normandy to the consumption of acid cider, while Brunon and Rebulet regard the frequent admixture of sea water with that local drink as the deleterious agent. Neither of these views, however, has been endorsed by the committee appointed to investigate the subject, which seems to have considered that heredity was the principal cause of the prevalence of the complaint.

Although indulgence in meat or alcohol does not appear to favour the inception of carcinoma, it is quite possible that the mischief may be due to the inordinate consumption of some other article of diet. A comparative study of the food of savage and civilised communities at once indicates that at least two common articles of diet are usually wanting among those who

appear to be naturally exempt from malignant disease. The first of these is bread made with yeast, and the other beer. It is also a curious fact that among the poorest agricultural populations, where these two products of civilisation are rarely employed, carcinoma is supposed to be rare, while in those districts where one or other is taken in excess the complaint is exceptionally common.[1] It is also interesting to observe that modern pathologists are inclined to regard the cell-enclosures met with in carcinoma as more closely allied to yeast than to protozoa, and should this identity be established it will certainly be advisable to ascertain whether all or only a portion of the fungus employed in the preparation of bread and beer is really killed in the process of manufacture.

10. Hygiene

The frequent occurrence of carcinoma of the stomach in old houses and in those whose drainage systems are defective has led to the belief that insanitary conditions either predispose to or excite the disease.[2] It would appear, however, from the reports of the Registrar-General that the death-rate from cancer is comparatively low in densely populated districts, where the hygienic arrangements are imperfect and where the mortality from infectious complaints is the greatest. It is also less among those engaged in industrial employments than among the professional classes and shopkeepers; while in most of the large cities it is more prevalent in the wealthy quarters than in those of the poorer section of the population. These facts have induced certain authorities to regard luxurious living as an important factor in the etiology of malignant disease, but it might also be argued that the lesser mortality in early life among the rich permits a greater proportion to attain the age at which cancer is usually met with.

11. Traumatism and Mental Conditions

Carcinoma of the stomach occasionally follows a severe blow upon the epigastrium, just as an injury to the breast

[1] Table 19 indicates that brewers, inn-servants, innkeepers, and commercial travellers are unduly prone to cancer; while the prevalence of the disease among those exposed to soot and the products of copper-smelting suggests the possible influence of arsenic as a predisposing cause.

[2] Mason found that defective drainage existed in 25·7 per cent. of the houses where the disease occurred.

sometimes forms the starting-point of the disease in that organ. It is probable, however, that in both cases the effect of traumatism is to determine the location of the growth rather than actually to produce it, much in the same way that an injury in a tuberculous subject is apt to be followed by a local manifestation of the complaint. There are also a few instances on record in which a cancerous tumour of the stomach was found to contain a pin, a spicule of bone, or some other foreign body that had become embedded in the gastric wall and had given rise to chronic irritation of the tissues.

The older writers were wont to regard grief and mental trouble as important factors in the production of cancer, but of recent years these and similar views seem to have fallen into disrepute. No practitioner, however, who has had much experience of cancer of the digestive tract can fail to have been struck by its extreme frequency in men who have been subjected to great domestic trouble; and, for our own part, we are so convinced that continued mental worry is a predisposing cause of the disease that we make it a subject of inquiry in every case, and regard its existence as a fact of clinical importance.

12. Influence of Seasons

In the following table we have arranged 154 cases of carcinoma of the stomach according to the month in which the disease terminated and that in which it was supposed to have commenced.

TABLE 20

Month	Fatal cases		Percentage	Admissions to hospital		Percentage	Probable onset		Percentage
December	9			5			8		
January	6	22	14·3	10	22	14·4	26	53	38
February	7			7			19		
March	10			18			2		
April	13	37	24	15	41	27	25	30	21·6
May	14			8			3		
June	14			16			5		
July	18	42	27·2	19	45	29·6	13	26	18·7
August	10			10			8		
September	18			15			12		
October	19	53	34·4	18	44	29	11	30	21·6
November	16			11			7		

We have given preference to the lethal event because the accuracy of the figures upon this point is beyond dispute, whereas those that refer to the commencement of the complaint are always open to doubt. It will be observed that the death-rate varies at different times of the year, being lowest during December, January, and February, and highest in September, October, and November; or if the months be grouped according to seasons, that over 60 per cent. of the total deaths take place between June and November. These figures are, of course, too small to warrant any absolute conclusions being drawn from them, but at the same time they are too striking to be ignored, more especially as both Virchow and d'Espine noticed, fifty years ago, that persons affected with malignant disease die more frequently in the summer than in the winter. This fact is of itself somewhat curious, since one would have supposed that a disease which reduces the vitality to such a low ebb, and so often terminates by pneumonia, would be more likely to prove fatal to the poor inhabitants of London during the cold and wet winter months than in the more genial weather of the summer and autumn. At first sight it would seem as if an increase of the temperature of the air might stimulate the growth of a malignant tumour, in the same way that it does that of plants, and by accelerating its progress curtail the period of existence. That an increased rapidity of growth really does take place during the spring and summer is more than probable, for not only do cases succumb more quickly between April and August, but, as will be seen from the table, only about one-seventh of the total number were admitted into hospital during December, January, and February. Personally, however, we are strongly of opinion that carcinoma obeys certain laws of epidemiology, like enteric fever, acute rheumatism, and other infective diseases, and is consequently more rife at certain seasons than at others. If it be allowed that the usual duration of the gastric complaint varies from nine to twelve months, we should expect from the facts already noted that in the majority of the cases it would commence between September and February; and in this connection the last part of the table becomes instructive, for it will be observed that in 60 per cent. of the entire number the first symptoms of illness showed themselves within that period. We venture to believe that further investigation upon these lines will throw an important light upon the etiology of carcinoma.

13. Influence of Other Diseases

(*a*) *Gastric Ulcer.*— Cruveilhier was the first to point out that carcinoma is apt to attack the edge or scar of a simple ulcer, and the subsequent confirmation of this fact by Rokitansky, Dittrich, Brinton, and Hauser has led to the belief that a causal relationship exists between the two complaints. Thus, according to Lebert, 9 per cent. of all gastric cancers originate in this manner; but Rosenheim is disposed to reduce this estimate to 6 per cent. and Häberlin to 2·3 per cent. The widespread destruction of the tissues that results from a malignant growth usually obliterates every trace of a pre-existent ulcer or scar, and it is therefore necessary to surmise the former presence of such a lesion from a history of severe pain or hæmatemesis. Out of 134 cases in which special inquiries were directed by us to this question, only four, or 3 per cent., admitted having suffered from symptoms of this kind prior to the onset of the fatal complaint. As this result tallies closely with our experience in private practice, we are inclined to believe that not more than 3 per cent. of all cases of gastric cancer are preceded by simple ulcer. Even this, however, does not necessarily imply that the benign predisposes to the malignant affection, for, inasmuch as nearly 5 per cent. of the entire population suffer at one period or another from ulceration of the stomach, the two diseases must frequently occur in the same individual. It seems to us most probable that a simple ulcer, like any other local injury, merely helps to determine the location of the growth in a cancerous subject; and in support of this view it may be noted that while a healthy stomach rarely becomes the seat of metastatic growths, this immunity largely disappears if the organ happens to present a chronic ulcer.

(*b*) *Functional Disorders of the Stomach.*—Chronic gastritis does not appear to favour the growth of carcinoma, while the alcoholic variety is, if anything, inimical to its development. Functional disturbances are also rarely followed by the disease. Out of 134 of our cases in which details as to the previous health of the patients were noted, only 16 per cent. were mentioned as having suffered from any dyspeptic ailment before the symptoms of malignant disease presented themselves. Of nineteen persons who were the subjects of cancer of the cardia there was a history of dyspepsia in only one, who was said to

have been liable to 'bilious attacks.' Out of thirty-one in whom the body of the organ was the seat of the new growth, two had been subject to 'bilious attacks,' in one a simple chronic ulcer was discovered after death, and three, or 9 per cent., had occasionally suffered from some form of indigestion. Among eighty-four cases of cancer of the pylorus, fifteen, or 17 per cent., were recorded as having previously suffered from gastric derangement; but of these two had only been liable to 'bilious attacks,' in one a chronic ulcer was discovered after death, in three pain after food and hæmatemesis pointed to gastric ulcer as the probable cause of the trouble, while two had been liable to biliary colic and biliary calculi were found on post-mortem examination.

From the above facts we conclude that carcinoma rarely affects those who have been the subjects of chronic dyspepsia; that when such is the case the pyloric region is usually the seat of the new growth; and that the symptoms of the antecedent disorder may often be traced either to simple ulcer or to gallstones.

(*c*) *Benign Growths.*—Persons who present innocent tumours of the skin or internal viscera are not especially prone to carcinoma of the stomach. Among our fatal cases of that complaint, uterine fibro-myomata were only present in 3 per cent. and a cyst of the ovary in 0·5 per cent. of the females, while no instance of adenoma of the breast was recorded. Observations as to the existence of warts, lipomata, and other benign tumours are wanting in our hospital statistics, but from our own observations we are inclined to believe that these and other benign tumours are rare in the subjects of malignant disease of the stomach. Carcinoma has been occasionally found associated with adenomata of the stomach, but the attempt by Ménétrier to establish a causal connection between the two can hardly be said to have been successful.

(*d*) *Tuberculosis.*—The frequency of obsolete tubercle in persons who have died from gastric cancer has often been the subject of remark. In our own series one or both lungs presented signs of former tuberculosis in 15·8 per cent., while Lebert observed a similar condition in 14·7 per cent. of his cases. Although estimates relative to the frequency of the pulmonary lesion among persons who have died from all causes vary from 4·7 per cent. (Heitler) to 44 per cent. (Schlenker), it is probable that of all diseases carcinoma is most often associated

with obsolete tubercle. On the other hand, most authorities are agreed that the two complaints rarely coexist in an active state in the same individual, and that when carcinoma commences the tubercle usually ceases to progress. In one case of this kind, which we were able to watch throughout its course, a rapid tuberculosis of the lungs and intestines came suddenly to a halt when symptoms of malignant disease of the stomach and pancreas made their appearance, and after death, at the end of eight months, not only was the pulmonary lesion found to be completely quiescent, but more than thirty ulcers in the bowel had either partially or entirely cicatrised. It is probable, therefore, that while the two diseases are not wholly incompatible, the tubercle bacillus is unable to flourish in the same body as carcinoma. On the other hand, there is evidence to show that a proclivity to tuberculosis distinctly favours the inception of cancer. Among the general community a family history of tubercle exists from 10·8 (Dovey) to 28·5 per cent. (Kuthy), while Roger Williams found a similar history in 50 per cent. of his cases of uterine and mammary cancer, and 26 per cent. of our gastric cases possessed one or more near relatives who had succumbed to phthisis. It is also interesting to observe that the progenitors of cancerous families are often themselves the sole survivors of tuberculous families, and that while the cancerous proclivity shows itself most often in the elder children (Moore), the younger ones not infrequently succumb to consumption. In other instances cancer and phthisis alternate in successive generations.

(*e*) *Rheumatism.*—Rather more than 8 per cent. of our cases had suffered from acute rheumatism in early life, and in about 7 per cent. there was evidence of disease of the mitral or aortic valves. Considering how common rheumatism is among the inhabitants of the East-end of London, this proportion cannot be considered excessive.

(*f*) *Malaria and Syphilis.*—It has been asserted that carcinoma is rare in malarious districts, and that those who have suffered from ague are seldom afflicted with malignant disease. For such statements, however, we can find no justification. In England, one of the principal cancer districts is situated in those regions where malaria is chiefly encountered, and we have been assured by competent observers that in Africa men who have had many attacks of fever are in no way exempt from cancer. Owing

to its situation near the docks, cases of malaria are frequently admitted into the London Hospital, and our series of deaths from carcinoma of the stomach includes no fewer than eight men who had previously suffered from malaria. It is noteworthy that in two of these the malignant disease ran its course in less than five months. Several writers have remarked upon the comparative rarity of syphilis among the subjects of carcinoma, and our own experience is confirmatory of this. Of our hospital cases, only 6 per cent. of the men had apparently suffered from the disease, which is a very small proportion for the district from which they were drawn.

(*g*) *Apoplexy and Insanity.*—No particular stress can be laid upon the somewhat excessive frequency of cerebral hæmorrhage among the progenitors of those who die from gastric cancer, since many of them lived to an extreme old age. On the other hand, there seems to be a distinct connection between insanity and malignant disease, possibly through their mutual association with tuberculosis. Both melancholia and mania occasionally develop during the course of the gastric complaint, and in such cases there is usually a history of tuberculosis or insanity in the family.

CHAPTER IV

SYMPTOMATOLOGY

THERE are few diseases which at an early period of their course are more difficult to recognise than cancer of the stomach. The pain, vomiting, and hæmorrhage that are usually regarded as especially indicative of the complaint may not only be entirely absent, but occasionally exhibit such individual prominence as to suggest some other and less serious affection of the digestive organs. In other cases the existence of intense anæmia, accompanied by fever and general debility, appears to indicate a disorder of the blood-making viscera; while in not a few the symptoms which arise from secondary implication of the liver or peritoneum completely mask those of the original complaint.

In order to obtain a clear comprehension of the disease in its protean aspects it is necessary not only to study the clinical features of a large number of cases, but to compare the various symptoms presented by each with the nature, location, and distribution of the growth as determined after death. A writer who trusts solely to his own experience, however extensive that may have been, can hardly fail to be biassed by the recollection of certain cases which from some cause or another were unduly impressed upon his mind; while he who formulates his ideas from a series of isolated examples, collected from the periodical literature, courts every error that is inherent in an unverified diagnosis.

In order to avoid, as far as possible, these sources of error, we have based our clinical description of the disease upon the details afforded by 154 cases which were treated and carefully examined after death at the London Hospital and the London Temperance Hospital between 1893 and 1900. It will be readily understood that, owing to the difficulty of securing complete

uniformity in the record of the various symptoms, the entire number is not always available for the investigation of every point of interest.

(1) Mode of Onset.—It is the usual custom to describe the commencement of the complaint as insidious, and in the majority of the cases it is undoubtedly true that the local phenomena remain obscure until the morbid growth has either given rise to obstruction of an orifice or has undergone ulceration. We find, however, that in 9 per cent. of our cases the initial symptoms were stated to have appeared quite suddenly; and since in every instance there seems to have been considerable difficulty of diagnosis, it is advisable briefly to consider this unusual mode of development.

An abrupt onset may be marked by three varieties of symptoms. As a rule the patient is attacked by acute gastritis, which, instead of subsiding under treatment, assumes a subacute or chronic character and continues throughout the whole course of the complaint. Less frequently the first indication of illness consists of severe epigastric pain, which either persists more or less constantly, or assumes a paroxysmal character and is aggravated by food. Finally, in rare instances a profuse hæmatemesis, like that which occurs in simple ulcer, is the first symptom to attract attention.

(*a*) When the symptoms of *acute gastritis* usher in the disease, they are generally attributed by the patient either to over-indulgence in some article of food or drink, or to the imbibition of cold water or beer. In other cases exposure to cold, an attack of influenza, over-fatigue, excitement, or mental worry is regarded as the exciting cause of the complaint. Since, however, in every instance of this kind the pylorus is found to be obstructed after death, it is probable that the inflammatory disorder was really the outcome of retention and decomposition of the food. The general features of the illness are well shown in the following case.

Case I. A medical man, aged forty-three, engaged in a large practice in London, consulted us in October 1895 for indigestion. He stated that he had been perfectly well until the 9th of September, when, after attending a public dinner and eating more than was his habit, he felt very unwell and vomited a large quantity of undigested food. After taking the usual remedies and restricting his diet for a day or two, he found that instead of recovering the power of digestion

he was unable to take solid food without discomfort, and within a week was obliged to confine himself to milk and other liquid forms of nourishment. Since that time he had constantly suffered from nausea, flatulence, and acidity, had grown very weak, and had lost nine pounds in weight. On examination the stomach was found to be slightly dilated, and to contain a large excess of mucus, but no free hydrochloric or lactic acid. No tumour could be detected, nor was there any evidence of disease in the other organs of the body. But in spite of the most careful dieting and medicinal treatment, flatulence, acidity, and nausea ensued after every meal, and within a few weeks a strong aversion to food manifested itself. When seen a month later the patient was found to have lost nearly a stone in weight, and appeared extremely weak. The dilatation of the stomach was now marked, and its contents exhibited an abundance of lactic acid. There was also complaint of constant micturition, and on examining the pelvis a tender mass about the size of a walnut could be felt between the rectum and the bladder. Six weeks later the debility had increased so much that we found him confined to bed. Nausea and vomiting ensued about an hour after every meal, and the bladder symptoms were very troublesome. The abdomen was distended and contained a small quantity of free fluid, while several indefinite tumours could be felt near the umbilicus and in the left iliac fossa. Death occurred almost exactly five months after the onset of the acute symptoms, and at the autopsy there was found colloid infiltration of the pyloric half of the stomach, with implication of the omentum and pelvic peritoneum.

(*b*) When *acute pain* constitutes the first indication of the disease, the growth is usually localised to a comparatively small area of the stomach, and is found after death to be extensively ulcerated. It is probable, therefore, that sudden sloughing of its substance was the cause of the symptom in question. Not infrequently the pain develops soon after some physical effort, when the patient feels as though something had given way in his abdomen, and is seized with faintness and vomiting. Subsequently the suffering is more or less continuous, and is especially severe after meals or upon exertion. The following case is a good example of this mode of onset.

Case II. A labourer, aged fifty-two, was admitted into the London Temperance Hospital for severe pain in the epigastrium of six weeks' duration. He stated that one afternoon, while lifting a heavy weight, he had been seized with violent pain in the belly, which caused him to feel faint and to vomit. The pain continued intense

for three days, after which it subsided somewhat, but was always increased by the ingestion of food. Since the commencement of the illness he had lost more than a stone in weight and had become very weak. On examination the patient was observed to be much emaciated. The lower border of the stomach extended to the umbilicus, and immediately above and to the right of that spot an indistinct and tender tumour could be felt. The gastric contents were devoid of free hydrochloric acid but rich in lactic acid. The general condition rapidly deteriorated, and even milk soon gave rise to pain. At the end of a month a secondary nodule was detected in the right lobe of the liver, and death ensued from exhaustion about fourteen weeks after the onset of the pain. The autopsy revealed a malignant ulcer of the spheroidal-cell type, situated on the lesser curvature, close to the pylorus, with secondary growths in the liver and cœliac glands.

(*c*) *Profuse hæmatemesis* as an initial symptom is practically confined to ulcerating growths of the pylorus or cardia. Both in its quantity and general appearance the hæmorrhage closely resembles that of simple ulcer, and the case is usually regarded as an example of that disease until the continuous loss of flesh, anorexia, and increasing discomfort after food, lead to the suspicion of a malignant affection.

Case III. A man, aged fifty-five, was admitted into the London Temperance Hospital with the diagnosis of chronic gastric ulcer. It appeared from his history that he had been perfectly well until four months previously, when after supper one evening he suddenly turned faint and vomited a chamberful of bright blood. After remaining in bed for several weeks he tried to resume his former mode of life, but found that he had lost a great deal of flesh and was unable to take any solid food without experiencing pain in the epigastrium. Vomiting occurred occasionally at night, and the emaciation made rapid progress. On admission the stomach was found to reach two inches below the level of the umbilicus, and the peristaltic movements of the viscus were clearly visible through the attenuated parietes. No tumour could be detected, but as a result of a test meal the gastric contents were shown to be devoid of free hydrochloric acid. Despite lavage and careful dieting he grew steadily worse, and died five weeks after admission. The necropsy revealed scirrhous carcinoma of the pylorus with extensive ulceration.

In all cases where the disease appears to begin in an acute manner, it will be observed that the physical signs show that the growth has already made considerable progress, while the

total period covered by the subjective symptoms seldom exceeds more than a few months.

(2) Pain.—Malignant diseases are so often accompanied by pain that it might reasonably be expected that a cancerous growth in a highly organised structure like the stomach would be associated with considerable suffering. In the majority of cases pain certainly constitutes the most prominent of the local symptoms; but occasionally it is conspicuous by its absence, not only at the commencement, but throughout the whole course of the malady. Brinton estimated the frequency of these *painless* cases at 8 per cent., and Lebert at 25 per cent., while in 14 per cent. of those in our hospital series it was stated that pain was either absent altogether or extremely slight. As this latter figure tallies with the experience of Osler and McCrae (13·3 per cent.), we are inclined to adopt it as the nearest to the truth. The pain varies greatly, not only in different cases, but also in the same individual at different times, being sometimes aching or burning in character, intermittent in appearance, and moderate in degree, while at others it is stabbing or lancinating, agonising, and more or less continuous. In 48 per cent. of our cases the symptom was described as 'severe' or 'continuous,' and in 38 per cent. as 'occasional.'

Situation.—The part of the abdomen to which the pain is referred varies to a great extent according to the situation of the growth. In pyloric disease the epigastrium, right hypochondrium, or even the umbilical or hypogastric region, may be the chief seat of the suffering, according as the pylorus maintains its usual position or has been dislocated by traction of the enlarged stomach. When the body of the organ is affected, pain is principally experienced in the epigastrium or left hypochondrium, while in disease of the cardia it is often felt in the left side of the chest, in the throat, or behind the lower end of the sternum. Pain in the back is most often encountered with disease of the posterior wall, associated with ulceration of the growth and adhesions between the stomach and the pancreas or the vertebral column. Moderate pain, such as arises from flatulent distension of the viscus in the early stages of pyloric stenosis, is usually referred to a spot in the centre of the chest, beneath the left mamma, or between the shoulders.

Radiations.—At the climax of an attack the pain may become diffused over a large area of the body, or be reflected

along the course of certain nerves. Thus it not infrequently extends over the greater part of the abdomen and chest, or radiates to the back and upwards between the shoulders. Occasionally it is reflected along the nerves of the brachial, cervical, or lumbar plexuses; or, should the disease have involved an intercostal nerve, severe neuralgia may be experienced round the lower part of the chest or upper abdomen, accompanied, perhaps, by an herpetic eruption. Pain in the right shoulder is sometimes associated with the adhesion of a pyloric growth to the under surface of the liver; while invasion of the diaphragm is often accompanied by a sense of constriction of the thorax, with difficulty of inspiration and tenderness along the course of the phrenic nerves in the neck. Extension of the growth to the lumbar and sacral glands may give rise to pain in the nerves of the lower limbs which simulates sciatica, and extreme irritability of the bladder or rectum may ensue from implication of the pelvic peritoneum. In those rare cases where the disease destroys the spinal column constant localised pain in the back may be followed by paraplegia.

Time of Access.—At an early stage of the complaint pain is usually experienced after meals, and in this respect it resembles that of simple ulcer. As a rule, however, it is less acute, more variable in appearance, less localised, and often relieved by the eructation of gas. As the disease proceeds it gradually increases in severity, and becomes more continuous and less dependent upon digestion. It may also be observed that, unlike the pain of ulcer, it is often increased rather than relieved by a milk diet, and does not subside entirely after vomiting. The situation of the growth also exerts a certain amount of influence upon its development. When the cardiac orifice is involved, pain is usually experienced immediately after swallowing, and is excited more rapidly by solid food than by liquids, and by hot or cold drinks than by those of a medium temperature. Disease of the body of the organ is chiefly accompanied by pain after food, which in its situation and time of access closely resembles that of simple ulcer. The pain that accompanies carcinoma of the pylorus varies in its appearance, according as the growth has ulcerated or has given rise to obstruction of the orifice. In the former case there is usually an exacerbation within half an hour of the ingestion

of food, while in the latter a sense of distension and abdominal discomfort ensues immediately after meals.

Effect of Posture.—The subjects of simple gastric ulcer often find relief by lying upon the back or upon one side during an access of pain, and the position they habitually assume affords a general clue to the situation of the ulcer. In malignant disease of the stomach, however, a recumbent posture usually aggravates the pain, and the patient repeatedly turns from side to side in his efforts to obtain relief, or walks about the room. This extreme irritability under the influence of pain is very characteristic, and its existence will often suggest the possibility of malignant disease even when the other features of the complaint seem to favour a diagnosis of simple ulcer.

Cause and Variations.—The main cause of the pain which accompanies a new growth in the stomach is undoubtedly the progressive infiltration of the tissues and the compression which is exerted upon the gastric nerves by extension of the disease along the perineural sheaths. There are, however, several other conditions which tend to modify both the severity of the symptom and its time of access.

(*a*) *Influence of Age.*—It is often stated that old persons suffer much more severely than those of middle life. To test the accuracy of this view we have arranged in the following table the ages of our various patients and the degrees of pain that accompanied their complaint.

TABLE 21.—THE RELATION OF AGE TO THE SEVERITY OF THE PAIN

Pain	Under 45 years	45 to 60	Over 60
Absent or slight . .	10%	15%	14%
Occasional . . .	48%	33%	36%
Severe or continuous . .	42%	52%	50%

It will be observed that while pain in one form or another is more frequent at the earlier period of life, continuous or severe suffering is slightly more common after forty-five years than among younger patients.

(*b*) *Influence of Situation.*—The degree of pain varies according to the location of the growth. Brinton asserted that the symptom was most frequent and severe when the orifices of the stomach were involved by the disease, and this statement has usually been repeated by subsequent writers. Our own

experience, however, has always led us to regard disease of the body of the stomach as the variety which is pre-eminently painful, and this appears to be confirmed by an analysis of our hospital cases.

TABLE 22

Situation	No pain	Severe pain	Occasional pain
Cardia	24%	43%	33%
Walls and curvatures .	3%	66%	31%
Pylorus	15%	42·5%	42·5%

An examination of the table shows that nearly one-fourth of the cases where the cardiac region was affected were devoid of pain, whereas this symptom was absent in only 3 per cent. of those in which the walls and curvatures of the organ were implicated. It is also obvious that severe pain was far more common in the latter than in the former. With regard to growths of the pylorus, pain was completely absent in 15 per cent., while the rest suffered equally from the occasional and severe varieties. It is interesting to note that when these cases were further classified according as the pyloric orifice was obstructed or not, an absence of pain was found to be entirely confined to the former class. The explanation of this phenomenon seems to be that when a malignant growth infiltrates the pylorus, without causing much obstruction, the mucous membrane is usually ulcerated and the disease often extends into the body of the stomach. On the other hand, a contracting scirrhus which produces great stenosis of the outlet is seldom extensive, and is usually accompanied by excessive vomiting, which in itself is rarely compatible with continued pain.

(c) *Influence of Ulceration.*—Severe pain after meals is always suggestive of ulceration. We have therefore compiled the following table, in order to show the relation between these two conditions in carcinoma of the different regions of the stomach.

TABLE 23.—THE RELATION OF PAIN AFTER FOOD TO ULCERATION OF THE GROWTH

Situation	Ulceration present	Pain after food
Cardia	43%	33%
Walls and curvatures . .	57%	37%
Pylorus	48%	46%

These figures are interesting from two points of view. In the first place, if they are compared with those shown in Table 22 (p. 113), it will be seen that the frequency of 'pain after food' and of 'occasional pain' is practically identical in growths of the same region of the stomach. In other words, that whatever designation is applied to this form of pain, it is due to direct irritation of the ulcerated surface by the food or its chemical products. In the second place, it is apparent that the liability to the symptom varies according to the situation of the disease. Thus, while it exists in almost every case of ulcerated carcinoma of the pylorus, it is present only in 76 per cent. of the cases of malignant ulceration of the cardia and in 65 per cent. of those where the central region of the viscus is affected. This apparent anomaly may be easily explained. As long as the pylorus remains unobstructed the gastric contents find a ready exit into the duodenum; but if the orifice is contracted, both the food itself and the organic acids which arise from fermentation tend to accumulate in the stomach and to produce direct irritation of the raw surface. It is also probable that the severe and continuous form of pain that accompanies disease of the body of the organ frequently masks the less intense suffering that ensues from the ingestion of food.

(*d*) *Extent of the Growth.*—So many factors are concerned in the causation of the pain that it is impossible to determine whether the histological character of the growth exerts any decided influence upon the severity of the symptom. As it is often asserted, however, that diffuse infiltrations are more painful than localised growths, we have analysed our cases upon this basis.

TABLE 24.—RELATION OF PAIN TO THE EXTENT OF THE GROWTH

Pain	Diffuse infiltration	Localised growth
Absent or slight . . .	14%	9%
Occasional	33%	34%
Constant	53%	57%

It would appear that as a rule a circumscribed tumour is rather more often accompanied by pain than the diffuse variety, possibly on account of its greater tendency to deep ulceration and to the production of metastases.

(*e*) *Secondary Growths.*—The gradual increase of pain which often marks the progress of the disease might possibly

arise from implication of the peritoneum or of the neighbouring viscera. To ascertain the truth of this supposition we have analaysed our cases in the following way.

TABLE 25.—RELATION OF PAIN TO SECONDARY GROWTHS IN THE ABDOMEN

Nature of pain	Growths in liver	Growths in peritoneum	Liver and peritoneum normal
Absent or slight . . .	7%	2%	14%
Occasional	40%	19%	38%
Constant	53%	79%	48%

It would appear that while metastases in either tissue increase the tendency to pain, the symptom is most severe when the peritoneum is involved by the morbid growth.

Conclusions.—(1) Some degree of pain is present in about 85 per cent. of all cases. (2) The milder forms usually arise from flatulence, while the more severe are due to the infiltration and destruction of the gastric tissues. (3) Pain after food is a prominent symptom in 38 per cent., and is almost invariably associated with ulceration of the morbid growth. (4) Severe or constant pain occurs in 48 per cent. of all cases. If it arises at an early stage of the complaint, the walls or curvatures are usually affected, but as a late phenomenon it is often due to implication of the peritoneum or to metastatic growths in neighbouring viscera. (5) Its location and radiations vary with the situation and extent of the disease.

(3) **Vomiting.**—According to Brinton, vomiting occurs in 87·5 per cent. of all gastric cancers. Lebert observed it in 80 per cent. of his cases, while in our own series it was recorded in 87 per cent., and in 9 per cent. it constituted the initial symptom of the disease. Like pain, it varies greatly in severity, in some instances appearing only at an advanced stage of the complaint, while in others it either occurs at intervals or is so frequent as to take precedence of all the other symptoms. An analysis of our 154 cases gives the following results: no vomiting in 13 per cent., occasional vomiting in 7 per cent., frequent vomiting in 80 per cent.

(*a*) Complete *absence of vomiting* is so very exceptional that the term 'no vomiting' must be held to imply that the symptom was so unimportant that it failed to attract the attention of the patient. In most of these cases the disease appears in

the form of a localised growth upon the posterior wall or curvatures of the stomach, though occasionally a considerable area may be involved, provided the orifices are not obstructed. The stomach shown in fig. 12, p. 14, was taken from a man who vomited only twice during the whole course of his illness. It is important to observe that in all these cases pain is usually excessive, and that in many of them the liver becomes affected with secondary growths at a comparatively early period of the disease. Absence of both pain and vomiting is very rare, and was noted only once in our series of cases (0·65 per cent.).

Latency of the symptom may arise from several causes. In the first place, it is well known that the normal excitability of the vomiting centre in the medulla oblongata varies considerably in different individuals, some being affected with sickness from the most trifling causes, while in others the induction of vomiting is a matter of the greatest difficulty. Again, frequent vomiting rarely coexists with severe gastric pain, on account of the restricted diet and the constant use of opiates which the suffering necessitates. Finally, the profound general exhaustion which accompanies the progress of the malignant disease gradually depresses the nervous system and diminishes its reflex functions.

TABLE 26.—SHOWING THE RELATIVE SEVERITY OF THE VOMITING IN CARCINOMA OF DIFFERENT REGIONS OF THE STOMACH

Situation	Vomiting absent	Occasional	Frequent
Walls and curvatures	24·5%	23%	52·5%
General infiltration	11%	5%	84%
Pylorus (without stricture) . . .	17%	3%	80%
Pylorus (with stricture) . . .	3%	3%	94%

(*b*) *Occasional vomiting* is characterised by attacks of emesis, which recur at irregular intervals throughout the course of the disease. As a rule they do not appear until the third or fourth month, but occasionally they constitute the first symptom. The vomiting may occur quite suddenly, or it may be preceded by an increase of pain, flatulence, distension, or nausea. In the former case it often takes place in the early morning or before a meal, and results in the rejection of several ounces of viscid mucus; while in the latter it ensues after meals, and causes

the evacuation of a large quantity of undigested and fermenting food. In both instances the ejecta usually contain lactic acid, but are devoid of free hydrochloric acid. The frequency of the symptom varies in different cases, in some occurring only every two or three weeks, while in others an attack is experienced every six or seven days. Its exciting cause is equally variable, an unduly large meal, indulgence in beer or wine, over-excitement, or exposure to cold or fatigue, being liable in many patients to produce sickness. In almost every instance pain, either constant or occasional, is a marked symptom, and as a rule the vomiting affords a welcome though temporary relief. A glance at Table 26 shows that occasional vomiting is most frequent when the morbid growth affects the walls or curvatures of the stomach without implication of the orifices, and it may therefore be attributed partly to local irritation of the gastric nerves, and partly to the chronic gastritis which always accompanies the disease.

(*c*) *Frequent vomiting* occurs in the great majority of cases at a late stage of the disease, and is present in some throughout its entire course. Its time of advent and its severity depend chiefly upon the situation and extent of the growth and the existence of ulceration.

The most characteristic variety is met with in stenosis of the pyloric orifice. In this condition severe pain is rarely experienced, but flatulence, distension, and acidity are always prominent symptoms. When the disease commences at the pylorus, and implicates the valve, vomiting may be present from the first; but when the growth induces rigidity of the tissues, or merely involves the outlet by a process of extension, five months or more may elapse before the sickness becomes frequent. At first the attacks are only occasional, and chiefly occur during the night or after an unduly large meal; but with the progress of the complaint they become more and more frequent, until vomiting takes place every few days. At this period the sequence of events is somewhat as follows: loss of appetite and the discomfort that ensues after meals have induced the patient to restrict himself to liquid or semi-solid food, but even under these circumstances he suffers every second or third day from abdominal distension, acidity, and nausea. In order to procure relief he will often induce vomiting by inserting his finger down the throat; but very

soon the symptoms culminate spontaneously in emesis, whereby the stomach rids itself of a large quantity of sour fermenting material. Comparative comfort is enjoyed for the next twenty-four hours, after which time the symptoms of maldigestion recur, to terminate once more in vomiting. Although intense nausea may be experienced, very little effort is required to evacuate the stomach, the process being one of gentle regurgitation, which is markedly favoured by a recumbent posture. Gradually the intervals of relief become shorter, until hardly a day passes without one or more attacks of emesis. This condition may persist until the end, or it may subside a few days before death owing to profound exhaustion and inability to take nourishment.

Subsidence of the vomiting at an earlier period may ensue either from sloughing of the growth which had caused the obstruction, or from the establishment of a fistulous communication with the intestine. The former is often accompanied by severe epigastric pain and diarrhœa, and sometimes by melæna or hæmatemesis, after which the patient experiences much relief. Should the orifice remain patent, this amelioration may continue for some time; but if the exuberant growth recurs the former symptoms gradually reassert themselves. The formation of a fistula is a late event in the disease, and the relief it affords is usually evanescent.

The ejecta in the cases of pyloric stenosis are very characteristic. The quantity varies from three-quarters of a pint to two quarts or more, and the semi-liquid material is dark brown in colour and possesses a sour, sickly, pungent, rancid, or even an offensive smell. When filtered the fluid is found to be acid in reaction, owing to the presence of lactic acid, but free hydrochloric acid is usually absent. Occasionally acetic or butyric acid may be detected in it. The residue upon the filter-paper consists of masses of undigested food and a large quantity of mucus. One of the most important features of the vomit is the appearance in it of some article of diet which had been swallowed at a distant date, such as date or grape skins, beans, peas, currants, corn, grape-stones, or orange-pips. In one of our cases some french beans were vomited in an unaltered state nearly four weeks after they had been eaten. Microscopical examination of the sediment reveals various kinds of *débris*, sarcinæ, torulæ, micro-organisms, red corpuscles, and

occasionally minute particles of the morbid growth. Offensive vomit usually denotes putrefaction of the proteid constituents of the food, but in rare cases it arises from sloughing of the growth. A fæcal odour indicates intestinal obstruction or gastro-colic fistula.

The periodic vomiting of pyloric stenosis is liable to be superseded from time to time by urgent and continuous sickness, which persists for several days and entirely precludes the administration of food by the mouth. This variety is usually due to an attack of subacute gastritis, caused by retention and decomposition of the food; but occasionally it arises from peritonitis at the base of the growth, from kinking or twisting of the duodenum, or from secondary obstruction of the colon. In rare instances the impaction of undigested material or a foreign body in the contracted pylorus leads to a rapidly fatal termination.

Case IV. A man, forty-nine years of age, was admitted into the London Hospital for incessant vomiting of three days' duration. It appeared from his history that for several months he had suffered from indigestion and loss of appetite, and latterly had vomited every third or fourth day. He had also lost much flesh. Three days previously the sickness had become incessant, and was accompanied by a dull pain at the epigastrium. On examination the man appeared profoundly ill, the eyes being sunken, the extremities cold, and the pulse hardly perceptible. About every ten minutes he was seized with urgent retching, and rejected about an ounce of an opalescent, alkaline, mucoid fluid. The stomach was dilated, and an ill-defined tumour could be felt in the region of the pylorus. Death occurred from syncope within twelve hours of admission. The necropsy showed cancerous infiltration of the pylorus, in the contracted orifice of which a damson-stone was firmly impacted.

Ulceration of the growth may give rise to a species of vomiting similar to that which occurs in simple ulcer. In such cases the lesion is usually situated near the pylorus, though it need not necessarily obstruct the orifice. Epigastric pain is either excited or increased by the ingestion of food, and is only partially relieved by the evacuation of the gastric contents. This form of frequent vomiting rarely persists more than a few months. As a rule, either it merges into that which characterises pyloric stenosis, or the attacks become less frequent as the disease progresses and metastases in the liver

present themselves. The ejecta consist entirely of undigested food mixed with mucus, and perhaps with altered blood. Free hydrochloric acid is usually absent, but lactic acid may be present in excess.

Diffuse infiltrations of the stomach also produce frequent vomiting by contracting the organ and destroying its muscular tissue. In such the patient feels that the capacity of his stomach is limited, and any attempt to overtax it is followed by regurgitation of the surplus quantity. Should the pylorus be stenosed, periodic vomiting may also occur, the only difference from the usual type being that the vomit is comparatively small in amount. If ulceration exists, pain as well as sickness may follow the administration of food.

(4) **Hæmorrhage (Hæmatemesis and Melæna).**—It is probable that some degree of hæmorrhage occurs in every case of cancer of the stomach, and that in many it is practically continuous; but since its clinical recognition depends upon its severity and the coexistence of vomiting, its frequency has been variously estimated by different writers. Thus, Brinton noted hæmatemesis in 42 per cent. of his cases, Lebert in 12·5 per cent., Boas in 36 per cent., Osler and McCrae in 24 per cent., and Rosenheim in 50 per cent.; while in our own series it was present in 34 per cent. The clinical aspect of gastric hæmorrhage varies according to the quantity of blood which is lost, and may be appropriately described under the terms 'slight,' 'moderate' and 'severe.'

(*a*) *Slight hæmorrhage.*—In this category are included those small but frequent losses of blood which ensue from superficial ulceration of the growth or from engorgement of its vessels and of those of the surrounding mucous membrane. The bleeding may occur spontaneously or it may be excited by the ingestion of food; while occasionally the use of alcohol, severe retching, straining at stool, or pressure upon the epigastrium appears to be the determinant factor in its production. The liability to this form of hæmorrhage is also increased by any condition which increases the pressure of the blood in the gastric vessels or which materially alters the composition of that fluid. Thus, frequent venous oozing is very common when the disease is complicated by a valvular affection of the heart, cirrhosis of the liver, interstitial nephritis, enlargement of the spleen, or leuchæmia. In some women it is especially apt to occur just

before the catamenial period. The amount of blood effused on each occasion varies from a drachm to three or four ounces. If vomiting occurs the ejecta present a brown tinge and gritty appearance (coffee-grounds), owing to the conversion of the albuminous constituents of the blood into globulin and the reduction of the hæmoglobin to insoluble hæmatin. Several substances besides blood impart a brownish tint to the vomit, as, for example, red wines, coffee, and the various preparations of iron; while a similar colouration of the stools may be produced by the administration of bismuth and calomel. It is therefore important that in every case the vomit should be carefully examined for brownish-black masses or flakes. Under the microscope these minute particles are seen to be composed of granules of pigment mixed with shrunken red corpuscles; and if there is any doubt as to the nature of the colouring matter, resort should be had to the following process, devised by Korczinski and Jaworski. A small quantity of the suspected material is mixed in a porcelain dish with a few grains of chlorate of potassium and a drop of hydrochloric acid, and gently evaporated to dryness. If any altered blood is present, the addition of a dilute solution of ferrocyanide of potassium to the residue produces an intense blue colour. The filtered vomit may also be examined for blood by Weber's modification of the guaiacum test. The filtrate is mixed with one-third of its bulk of glacial acetic acid, and after being well shaken is allowed to stand for a short time. Ten cubic centimeters of the fluid are then measured off into a test-tube, and to them are added ten drops of a freshly prepared tincture of guaiacum and twenty-five drops of turpentine. If any blood is present the mixture acquires a violet-blue colour, but under other circumstances it appears reddish brown.

Frequent slight oozing of blood, although it may not be accompanied by immediate symptoms, always exercises a deleterious influence upon the general health. In addition to progressive debility, the skin and mucous membranes become manifestly anæmic, and shortness of breath, giddiness, or faintness is experienced on exertion. The appetite disappears, thirst is often excessive, and sleep is disturbed by attacks of palpitation and flatulence. If vomiting is absent and pain an unimportant symptom, the hæmorrhage

almost invariably escapes detection, and the case is usually regarded as one of pernicious anæmia. When, however, a soft tube is inserted into the stomach during the period of digestion, it is by no means unusual to find that the gastric contents are largely mixed with altered blood. This unexpected discovery was made in several cases which came under our notice for anæmia and indigestion, and in every instance where the bleeding appeared to be continuous a necropsy showed the existence of an ulcerated growth, usually of the scirrhous type. In several of these it was also observed that the degree of anæmia varied with the severity of the hæmorrhage, and that when the latter was controlled by treatment the anæmia became less intense. Boas has lately called attention to these facts, and states that he has observed twenty cases of cancer of the stomach in which constant hæmorrhage was detected by means of the tube. It must, therefore, be admitted that frequent oozing of blood may take place without the objective symptom of hæmatemesis, and that its existence can only be determined by a methodical examination of the contents of the stomach. Furthermore, there is reason to believe that this loss of blood is one of the chief causes of the so-called cachexia of gastric cancer.

(*b*) *Moderate Hæmorrhage.*—This variety closely resembles that which ensues from simple ulcer, and is generally evidenced by the vomiting of six to eighteen ounces or more of blood. This copious bleeding is usually brought about by the destruction of a medium-sized vessel in the submucous or subserous tissue of the stomach, but occasionally it arises from sloughing of a vascular growth, or from ulceration of an artery of some neighbouring viscus. It is most frequent when the orifices or the lesser curvature are the seat of disease, and is hardly ever encountered in growths which produce extreme stenosis of the pylorus. Brinton estimated that this form of hæmatemesis occurred in 7 per cent. of all cases of gastric cancer, but our own statistics indicate a frequency of 10·8 per cent. The colour of the vomit varies according to the rapidity of the effusion and the length of time the blood has remained in the stomach, sudden hæmorrhage and immediate vomiting being evidenced by the rejection of bright clotted blood, while a more tardy expulsion renders it darker in colour and more fluid in consistence. In many cases the hæmatemesis occurs

without premonition, but in others it is preceded by a sense of heat or fulness at the epigastrium, palpitation, a peculiar taste in the mouth, nausea, faintness, dyspnœa, or even convulsions.

The symptoms vary according to the severity of the hæmorrhage and the condition of the patient. If the loss of blood is strictly moderate in amount and the general nutrition good, the patient exhibits the usual signs of loss of blood. The face becomes pallid, the skin cold and clammy, and there is great restlessness and a desire for air. The pulse increases in frequency but diminishes in volume, and there is usually complaint of weakness, faintness, or vertigo. Occasionally palpitation, dimness of vision, noises in the ears, or a sense of emptiness and sinking at the epigastrium, are notable features of the attack. Dryness of the mouth and thirst are invariably present. During the continuance of the hæmorrhage the pulse is quick, small, and compressible, and in bad cases may cease to be felt at the wrist, while the temperature of the body is markedly depressed.

As soon as the bleeding has ceased a certain amount of reaction sets in, and the pulse increases in volume, though it still continues to exhibit the compressible and jerky character of an incompletely filled artery. The temperature also recovers itself, and may even rise one or two degrees above the normal, but the febrile reaction is much less noticeable than in cases of simple ulceration. During this period the cheeks become slightly flushed, the eyes sunken and surrounded by dark lines, the lips dry and cracked, and sordes may collect about the teeth. Owing in great measure to the prohibition of solid food, the tongue is dry and coated with a grey or brown fur, while the palate and throat are apt to be attacked by thrush. Thirst is always a prominent symptom, but all desire for food is absent. Among the minor symptoms, throbbing in the head, noises in the ears, palpitation, insomnia, and uncontrollable restlessness are the chief subjects of complaint.

As a rule the gastric symptoms remain temporarily in abeyance, and even when severe pain has preceded the hæmatemesis it almost invariably subsides for the time. The bowels are confined, and it may not be until they have been opened once or twice that a black appearance of the stool proves that some blood has found its way into the intestines. In other cases the first

evacuation is found to contain blood, and several liquid tarry motions are passed in rapid succession. The amount voided in this manner is usually in inverse proportion to the quantity vomited.

When the hæmorrhage occurs at a late stage of the disease, the symptoms are often modified by the low vitality of the patient. Thus, in many instances vomiting is absent, and an attack of syncope or collapse, followed by intense prostration, constitutes the only indication of the loss of blood. In others the first attack is followed by continuous vomiting of coffee-ground material, or small quantities of bright blood continue to be rejected at intervals. Not infrequently the bleeding is followed within a few days by intense pain after food, which prevents the administration of nourishment and leads to rapid loss of strength. Lastly, the hæmorrhage may induce a semi-comatose condition, from which the patient never rallies, or it is followed by pneumonia, profuse diarrhœa, or suppuration of the parotid gland, which rapidly destroys life. It is very rare for moderate hæmatemesis to recur at distant intervals.

(c) *Excessive Hæmorrhage (l'hémorrhagie foudroyante).*—Hæmorrhage of such severity as to prove immediately fatal is very rare. Brinton estimated its frequency at 1 per cent., and this tallies with our own figures (0·75 per cent.) and those of other writers. In most cases it ensues from rupture of the coronary, splenic, or gastro-epiploic artery, but occasionally the aorta, vena cava, or hepatic vessels are affected. Soft growths of the lesser curvature and of the cardiac end, which have undergone rapid sloughing with destruction of the gastric tissues, are the most common cause of the accident. As a rule the patient is suddenly seized with vertigo, becomes blanched, and loses consciousness. Sometimes convulsions occur. Not infrequently the shock is so great as to paralyse the nervous centres and to prevent vomiting. In such the stomach and intestines are found to be filled with blood after death, or a fluctuating tumour in the epigastrium, due to distension of the stomach with clot, may be detected before life becomes extinct. In other cases profuse hæmatemesis is followed by immediate and fatal collapse.

(5) **Disorders of Digestion.**—In addition to pain and vomiting, most of the subjects of gastric carcinoma also suffer from minor symptoms arising from derangement of the digestive organs.

The most important of these are anorexia, dysphagia, flatulence, nausea, pyrosis, and constipation.

Anorexia.—Loss of appetite is an important symptom of gastric cancer. Brinton observed it in 85 per cent. and Lebert in 80 per cent. of their respective cases. In our own series pronounced anorexia existed in 82 per cent., in 11 per cent. the appetite was normal, and in two instances (1·5 per cent.) it was apparently increased. As a rule the distaste to food shows itself after the dyspepsia has persisted for some time ; but in 34 per cent. of our cases it constituted one of the first symptoms of the complaint and persisted throughout its entire course. In the majority of these the growth was found after death to occupy the cardiac or central region of the stomach, and usually belonged to the medullary or cylindrical-celled type. When once it has appeared the anorexia usually increases in severity until it becomes absolute ; but occasionally it varies in degree from time to time, and may even disappear for a few days. At first it may only be meat or some special article of diet, such as fat, butter, or eggs, which proves distasteful, but as the disease progresses, and especially if it is accompanied by frequent vomiting, it becomes more and more difficult to persuade the patient to take any kind of nourishment. It may be noticed that the desire for tobacco and snuff is usually abolished, and that in rare instances a special though temporary craving exists for fruit, herrings, or jam. The way in which the anorexia shows itself varies in different cases. In the majority there is simply no wish for food ; in others constant nausea or difficulty of deglutition seems responsible for the loss of appetite, while occasionally the very sight of food is repugnant. The frequency of the latter phenomenon, however, has been much exaggerated, although when it exists it constitutes a very important and striking symptom. Thus, a lady who came under our care stated that the first indication of illness consisted in such extreme aversion to the sight of meat that she was unable to pass a butcher's shop ; and in another case we were assured by a gentleman that although he often felt inclined for food, the appearance of a joint upon the table at once excited nausea and sometimes made him vomit.

Dysphagia.—Difficulty of swallowing is by no means infrequent during the later stages of the disease. In many cases where the anorexia is extreme the patient ascribes his dislike

to food to an inability to swallow, and complains either that a special effort of deglutition is required to dispose of each mouthful, or that the ingesta become arrested in the œsophagus. The former condition is purely subjective in character, and is usually associated with some disturbance of taste or an alteration in the salivary secretion, while the latter frequently arises from flatulence, and is relieved by the eructation of gas. True dysphagia accompanies most malignant growths which involve the cardiac orifice or which extend into the œsophagus, and in such cases it constitutes the principal symptom. Occasionally, however, it arises from reflex spasm of the pharynx or œsophagus. Thus Ebstein and Eichhorst have recorded cases in which tetany of the constrictor muscles of the pharynx was associated with carcinoma of the pylorus, and Poncet, Ewald, and Osgood have related others where the spasm affected the lower segment of the œsophagus. Two cases of this description have come under our own notice. In the first the difficulty of swallowing was so great that the patient had to restrict himself to liquids, and even these often provoked choking and regurgitation. After death the pyloric third of the stomach was found to be infiltrated with spheroidal-celled carcinoma, but no organic obstruction existed to the passage of food into the viscus. The other case was remarkable from the fact that no stricture, either functional or organic, could be detected during life, so that the dysphagia was probably due to paresis rather than to spasm of the lower end of the œsophagus.

Case V. A man aged forty-eight became gradually affected with difficulty of swallowing, which in a few weeks prevented him from taking any solid food. Mouthfuls of milk and other liquids were easily disposed of, but if drunk hastily or in bulk the fluids gave rise to oppression at the chest, and were partially regurgitated. The insufficient nutrition produced rapid loss of flesh, and within a few months extreme debility necessitated his confinement to bed. The appetite was bad, and hiccough and gaseous eructations were a constant source of annoyance. Hæmatemesis was absent, and there was no complaint of pain.

On examination the stomach was found to be normal in size, and no tumour or localised tenderness could be detected in the abdomen. There were no signs of aneurysm or other thoracic tumour. A full-sized tube was passed without difficulty into the stomach, and a pint of milk introduced by it was retained without difficulty. Notwithstanding the absence of a stricture, the patient continued

unable to swallow, and forcible feeding (*gavage*) was instituted. For two or three weeks this proved very successful, and he rapidly put on weight, but subsequently discomfort ensued after each meal, and occasionally vomiting occurred. The stomach was now found to be dilated, and a sense of resistance was detected in the region of the pylorus. The food regurgitated after the tube was withdrawn, emaciation set in, and death ultimately occurred from exhaustion about five months after the onset of the dysphagia. At the necropsy the stomach was found to be moderately dilated, and the pylorus affected by a cancerous infiltration, which had produced slight stenosis. The cardiac orifice was patulous, but showed no sign of disease. The œsophagus was normal.

Nausea is present in 68 per cent. of all cases, and is usually experienced after meals or immediately prior to an attack of vomiting. A *constant feeling of sickness* constituted one of the earliest symptoms of the disease in 27 per cent. of our cases, and was usually accompanied by anorexia and loss of flesh, and occasionally by giddiness and retching in the early morning. It was most frequent and severe when the cardiac region was the seat of the growth, or where the pylorus was involved without the production of stenosis. The marked distaste to tobacco and fats often causes the nausea to be mistaken for 'biliousness.'

Flatulence.—This occurs in almost every case, and is responsible for many of the symptoms of dyspepsia. It is a constant phenomenon in stenosis of the pylorus, but comparatively infrequent when the cardiac orifice is obstructed. The special symptoms to which it gives rise vary greatly in severity. In some cases the patient merely experiences a certain amount of fulness and discomfort after meals, which are relieved by eructation, while in others painful distension of the abdomen and frequent belchings of gas persist for hours. Although it is usually increased by food, it is also troublesome in the intervals of digestion, and is particularly distressing during the night. Sometimes a sense of thoracic constriction amounting to severe pain ensues upon the slightest exertion, while at other times the upward displacement of the heart induces violent palpitation, throbbing in the head, or vertigo. Occasionally syncope or pain like that of angina pectoris occurs, or asthmatic attacks supervene after meals, accompanied by extreme breathlessness and cyanosis. Hot flushes, with headache, confusion of thought, somnolence and hiccough, also constitute a frequent source of complaint.

Under normal circumstances the gaseous contents of

the stomach consist of air which has been swallowed and a variable quantity of carbon dioxide, derived from the blood or from food-fermentation. The chyme itself, when removed from the stomach, exhibits very slight gas formation for several days, owing to the presence of hydrochloric acid, which controls the natural tendency to putrefaction. When, however, obstruction of the pylorus or inefficient peristalsis has delayed the transmission of food into the bowel, fermentation invariably occurs, and leads to the production of a considerable quantity of gas. This process can readily be studied and its activity estimated by filling a test-tube of medium size with the semi-digested food withdrawn by a tube, and inverting it over a small cup or glass beaker partially filled with the same material. If any gas is evolved it will collect at the upper part of the tube, where it can be roughly estimated by the amount of depression of the liquid column. When the digestive process is healthy little or no gas is observed at the end of three hours, but in cases of gastric dilatation a sufficient quantity may be formed in that time to occupy from half an inch to two inches of the tube. This evidence of excessive fermentation, if combined with an absence of free hydrochloric acid and an excess of lactic acid, constitutes valuable confirmatory evidence of malignant disease of the stomach. The gas collected in this manner or which is eructated by the patient consists approximately of nitrogen (33–47 per cent.), carbon dioxide (13–26 per cent.), hydrogen (21–32 per cent.), and oxygen (6–12 per cent.), with a variable quantity of marsh gas and of sulphuretted hydrogen.

Carbonic acid gas is chiefly derived from carbohydrate fermentation, and especially from that which converts lactic acid into butyric acid; but it may also be formed during the process of alcoholic fermentation. Hydrogen occurs as a by-product in the manufacture of butyric acid; while the nitrogen and oxygen are introduced into the stomach in the air which is swallowed with the food and saliva. The coexistence of marsh gas and hydrogen renders the gas inflammable. This was first demonstrated by Hoppe-Seyler and Kuhn, and has since been investigated by Van Tieghem, M'Naught, Ewald, and others. It would appear that marsh gas is rarely generated in the stomach, but frequently regurgitates from the intestine in cases of incompetency of the pylorus. The presence of

sulphuretted hydrogen may be explained in a similar manner, although there is reason to believe that this gas is occasionally produced in the stomach itself.

Acidity.—Burning sensations at the epigastrium, followed by scalding in the chest and throat and the regurgitation of an acid fluid which sets the teeth on edge, are much less frequent in carcinoma than in simple ulcer of the stomach. They are apt to occur, however, as an early symptom of pyloric stenosis, and even after vomiting has set in regurgitations of acid may accompany the attacks of flatulence. The symptom is most common during the night, and is relieved by emesis. It is due to excessive fermentation of the retained food, whereby lactic and butyric acids are produced in large quantities, which give rise to irritation of the stomach.

Water-brash is a frequent symptom, especially when the cardiac end is the seat of the growth, and sometimes precedes the other indications of disease by several weeks. It often occurs in the intervals of digestion, or just before a meal, and is accompanied by a constrictive pain at the epigastrium and the regurgitation of an ounce or two of thin insipid fluid. Sometimes severe pain is experienced in the chest and between the shoulders, or the attack is accompanied by palpitation. The fluid itself is neutral or alkaline in reaction, and consists almost exclusively of saliva. The pain and regurgitation probably arise from a spasmodic contraction of the œsophagus.

The Tongue.—This presents no special features, but varies in appearance in different cases and at different periods of the complaint. In 32 per cent. of our cases it was described as 'clean' or 'normal,' while in the remaining 68 per cent. it presented a greyish-brown or creamy fur, and was often stained with medicine. A moist and thickly coated tongue almost always accompanies excessive vomiting; but when pain is the chief feature of the case the organ is apt to be abnormally red, dry, and fissured. During the later stages of the disease it is often attacked by thrush. Alteration or loss of *taste* is frequently observed, and causes the patient to regard his food as insipid, pasty, slimy, bitter, metallic, or nauseous. Sudden aberration of taste sometimes marks the onset of melancholia or delusional insanity.

State of the Bowels.—Constipation almost always accompanies the onset of the disease, and becomes gradually more

and more pronounced as the case proceeds. As an early symptom it existed in 79 per cent. of our cases where the pylorus was affected, and in 36 per cent. of those in which the cardiac end of the stomach was primarily involved. It is probable that the inactivity of the bowel depends partly upon the diminished quantity of food which enters it, and partly upon the loss of fluid entailed by excessive vomiting. In nearly 4 per cent. of our cases the constipation was eventually replaced by intestinal obstruction. As a rule this condition was the result of direct invasion of the transverse colon by the malignant growth, but occasionally it was due to the formation of an abscess between the stomach and the bowel, to occlusion of the duodenum, or to cancerous peritonitis. In one case a second primary growth in the rectum gave rise to a stricture.

Diarrhœa constituted an early symptom in 4 per cent. of our pyloric cases, and in 13 per cent. of those where the disease involved the cardia. It is probably due to chronic irritation of the intestine by the acid products of fermentation. When diarrhœa replaces constipation at a late period of the complaint, it usually arises either from sloughing of a pyloric growth or from the establishment of a gastro-intestinal fistula.

(6) **Failure of Strength.**—Among the various subjective symptoms that accompany a cancerous growth of the stomach, gradual loss of strength is often the first to attract attention. Although inclined for work, the patient experiences a sense of weariness and lassitude in the afternoon which renders him irritable and restless. Gradually he finds that he is unable to pursue his avocation for the whole day, and is forced either to curtail his hours of business or to rest upon his back from time to time. In other cases loss of energy is more apparent than physical debility, so that a man who has always been remarkable for early rising and devotion to out-door exercise will decline to get up at the usual hour or to engage in any active pursuit. This change of habit is often so marked that medical advice is sought on account of some supposititious derangement of the mind, and on more than one occasion we have known elderly people suffering from carcinoma of the stomach condemned as hysterical, self-indulgent, or incurably lazy, owing to their invincible objection to physical or mental exertion. In many cases, however, careful examination will show that for some time there has been a steady loss of flesh, or that the debility is accompanied by

progressive anæmia and disinclination for food; while in others, and especially in those where the patient is engaged in a sedentary occupation, difficulty of mental concentration, dizziness, failure of memory, or want of decision accompanies the failure of strength. Finally, great depression of spirits, religious melancholy, or even delusional insanity, is sometimes associated with deterioration of the general health.

(7) **Loss of Flesh.**—Progressive emaciation is an invariable symptom. At first the loss of flesh is only slight, and if it attracts attention is usually attributed to the indigestion or loss of appetite; but with the progress of the complaint the weekly loss steadily increases, until it may amount to five pounds or more. In our hospital cases the total loss was found to vary according to the duration of the disease, the situation of the growth, and the sex of the patient. Thus, in the male cases the average weight at the time of death was 111 pounds, and in the female ninety-one pounds; and since the average weight of a healthy male at fifty years of age is 148 pounds, and of a female 128 pounds, there was loss in the former sex of 25 per cent., and in the latter of 29 per cent. of the total weight of the body. In both sexes the loss was greater when the disease occurred below the age of forty-five years than after that period. The emaciation was also more severe when the orifices of the stomach were affected than when the body of the viscus was the seat of disease. Thus, with growths of the cardia and pylorus the average weight in males at the time of death was 109 and 110 pounds respectively, while in disease of the central region of the organ it amounted to 114 pounds. The occurrence of multiple deposits in the liver and other viscera appeared to compensate in some degree for wasting of the soft tissues, since in these cases the average weight at death amounted to 115 pounds. It must be borne in mind, however, that the production of metastases always hastens the fatal termination, and consequently curtails the period of emaciation. The average loss of weight per week in the various cases was as follows:

Under 1 pound in	26%
1 to 2 pounds in	35%
2 to 3 pounds in	21%
3 to 4 pounds in	16%
4 to 5 pounds in	2%
	100%

In 15 per cent. of the entire number an initial gain was observed, which lasted from ten days to three weeks and varied in amount from two to eleven pounds. In all these cases the patient was suffering from obstruction of the cardiac or pyloric orifice, so that the improvement which was manifested may be ascribed to the better methods of feeding which the patients enjoyed when they entered the hospital.

Occasionally this improvement is of much longer duration and the gain in weight is considerable. In a case recorded by Keen and Stewart the patient put on sixty-three pounds of flesh within four months of an exploratory laparotomy which confirmed the existence of carcinoma. In other instances an increase of appetite, renewed hope of recovery, the employment of rectal feeding, or the performance of gastrostomy or gastro-enterostomy is followed by a steady gain, which lasts for several weeks. On the other hand, extension of the disease to the œsophagus or pylorus rapidly augments the progress of the emaciation. A *sudden* increase of weight usually indicates effusion of fluid into the peritoneal or pleural cavities or a rapid invasion of the liver.

As a rule the superfluous fat of the body, and especially that situated in the omentum and mesentery, is the first tissue to undergo absorption. In consequence of this stout people will frequently remark upon their diminution in girth before their attention is attracted to the wasting of other parts. Next to the abdomen, the mammæ, neck, cheeks, and hips exhibit the earliest loss of substance, and the skin becomes loose, flabby, and devoid of elasticity. All the voluntary muscles become attenuated, the first to show signs of atrophy being the adductors of the thighs, the pectorals, the gastrocnemii, the interossei in the hands, and the temporals. Among the internal viscera, the heart and spleen are more affected than the liver and kidneys (p. 72). The diminished power of absorption and the excessive quantity of fluid lost by vomiting also contribute to the general loss of weight, and produce the sunken appearance of the eyes and the shrivelled claw-like hands, which invariably attract attention during the later stages of the complaint. In many cases the failure of nutrition is accompanied by a rapid whitening or falling out of the hair, and occasionally the long bones grow thin and brittle and are unduly prone to fracture.

(8) **Anæmia (Cachexia).**—Loss of colour has long been recognised as one of the most striking features of malignant disease, and extreme pallor of the lips and conjunctivæ is always a prominent symptom of the gastric complaint. The anæmia is usually most pronounced when the growth has undergone ulceration or has given rise to metastases in the liver and other viscera. It is also a marked feature in cases which present a constant elevation of temperature. An intense form, which is accompanied by a lemon tint of the skin and is closely comparable to that of idiopathic or pernicious anæmia, is met with in about 18 per cent. of all cases. The changes which occur in the blood are partly due to the absorption of the chemical products of the new growth, but chiefly, we believe, to frequent small hæmorrhages, since in almost every case of profound anæmia there is either a history of repeated hæmatemesis or the contents of the stomach when withdrawn by a tube constantly contain altered blood (p. 121). The total quantity of blood in the body becomes gradually reduced as the disease progresses, and its density also diminishes. This latter feature is particularly noticeable when the hæmoglobin percentage is very low (Schmalz, Lyonnet).

Red Corpuscles.—In every case there is a notable diminution in the number of red corpuscles (Laache). The average number at the time when the tumour becomes palpable is about 3,500,000 per cubic millimetre, though occasionally it reaches 5,000,000 or falls as low as 1,500,000. A relatively high count, or even polycythæmia, is occasionally encountered in cases of pyloric stenosis accompanied by excessive vomiting. It is worthy of notice that the corpuscular richness in gastric cancer seldom increases under treatment, but at the same time the number of red cells rarely falls below 1,500,000 per cubic millimetre. The former peculiarity serves to distinguish the disease from many other forms of secondary anæmia, and the latter from the pernicious variety, where, according to Henry, the cells always number less than 1,000,000 per cubic millimetre before death occurs. When stained films are examined by the microscope, the red corpuscles show moderate variations of shape, and not infrequently poikilocytosis. Lépine has observed microcytes in such numbers that they equalled half the total number of red cells; while other writers have described the presence of nucleated corpuscles of various

sizes. Typical megaloblasts, however, are rarely, if ever, encountered.

White Corpuscles.—An increase in the number of white corpuscles (leucocytosis) occurs in the majority of the cases, and is most frequent in growths of the medullary or cylindrical-cell type, but it is not apparently influenced by the presence of ulceration or of metastases. It is often very marked when the disease is accompanied by pyrexia or by a localised abscess in the peritoneum. If the normal number of white cells is reckoned at 7,000 per cubic millimetre of blood, nearly 60 per cent. of all cases of gastric cancer exhibit an excess, while more than 25 per cent. present 15,000 to 25,000 per cubic millimetre. This latter number, which was observed in three cases of our series, has induced Alexandre and other writers to describe a special variety of the disease by the term 'Leuchæmic Cancer.'

Microscopical examination of a stained film always shows a slight excess of polymorphonuclear cells; and according to Sailer and Taylor there is often a preponderance of the large mononuclear forms over the lymphocytes. Van Valzah and Nisbet state that myelocytes are frequently present, but this is disputed by Osler and McCrae. Eosinophiles occur in small numbers.

Digestion Leucocytosis.—Under normal conditions the number of white cells in the blood is increased during the period of gastric digestion, and a similar phenomenon is observed in chronic ulcer and in most of the functional disorders of the stomach. In malignant disease, however, Müller states that this temporary leucocytosis usually fails, and his observations have been confirmed by Rieder, Schneyer, and Hartung. The last-named has also observed a similar absence in cases of atrophy of the stomach secondary to carcinoma of the breast. On the other hand, Osler and McCrae observed digestion leucocytosis in nearly one half of the cases they examined, a result which tallies closely with our own experience. It must therefore be admitted that while the absence of digestion leucocytosis may help to confirm a diagnosis of carcinoma, its presence in no way negatives a suspicion of malignant disease.

Hæmoglobin.—The colouring matter of the blood is invariably reduced, the average quantity varying from 50 to 30 per cent. of the normal. The hæmoglobin value of the indi-

vidual corpuscles is also diminished to a much greater extent than in cases of pernicious anæmia (Lépine).

(9) **Temperature.**—The absence of fever in cancer generally has led to the impression that malignant disease of the stomach is a non-febrile complaint. As a matter of fact, however, nearly one third of all cases of gastric carcinoma exhibit an elevation of temperature at some period of their course, while occasionally the pyrexia is so prolonged and severe as to lead to serious errors of diagnosis (Hampeln, Devic and Chatin, Hanot). An analysis of our cases with reference to this point gives the following results:

Temperature normal or subnormal in	68%
Occasional elevation in	17%
Constant elevation in	15%

In the apyrexial cases, which constitute about two-thirds of the entire number, the temperature remains at or just below the normal point until a week or two before death, when it steadily falls to 97° or 96° F. Even in this condition, however, diurnal variations may still be observed. The lowest temperatures are usually met with in the autumn and winter months.

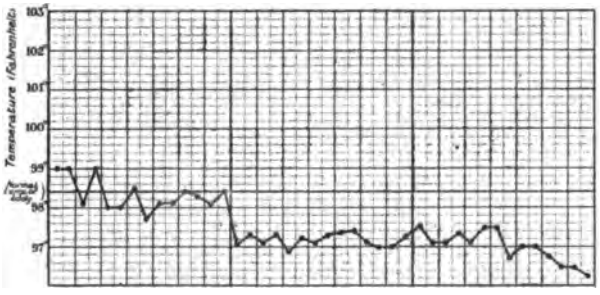


FIG. 30.—Chart showing the depressed temperature which usually accompanies the later stages of the disease. (London Temperance Hospital.)

Occasional attacks of fever may occur throughout the entire course of the disease, or they may develop only during its later stages. In the former case the sudden rise of temperature is often accompanied by chills, headache, or pains in the limbs, and the mercury in the thermometer may rise to 102° or 103° F., and remain at this point for two or three days. If deferves-

cence takes place suddenly, it is often accompanied by sweating, vomiting, or diarrhœa, but when the fall occurs gradually it is not attended by special symptoms. Between the attacks the evening temperature often rises to 99° F.

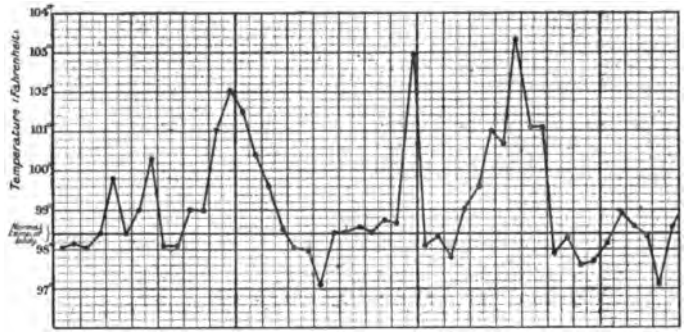


FIG. 31.—Chart of a case of adeno-carcinoma of the body of the stomach, showing occasional attacks of fever. (London Temperance Hospital.)

Continued fever occurs in several forms. As a rule it is distinctly remittent, the evening reading being 100–101° and the morning 99–100° F. In other cases the temperature always falls below normal in the morning, and the chart consequently

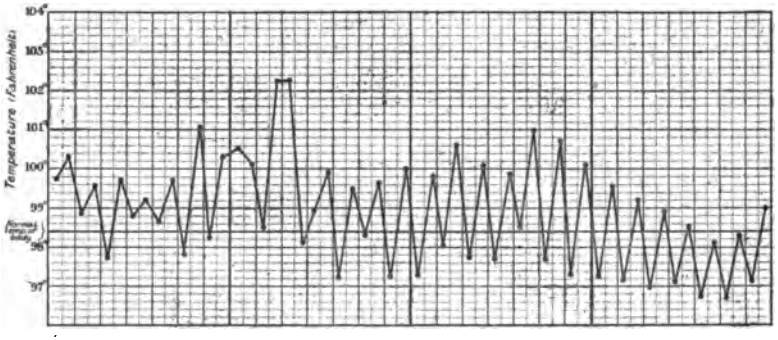


FIG. 32.—Chart of a case of soft cancerous growth of the posterior wall of the stomach, showing continued fever. (London Temperance Hospital.)

resembles one of suppuration or chronic phthisis. Both varieties may continue for several months, but with the progress of exhaustion the evening exacerbations become less marked, until an apyrexial condition supervenes. Finally, in rare cases the temperature remains constantly elevated above 100° F., and

is accompanied by shiverings, sweatings, and other indications of septicæmia.

The origin of the fever has been variously attributed to ulceration of the growth, to the presence of metastases, to inflammation of the peritoneum, to general carcinosis, or to some other complication of the disease; but while it must be admitted that one or more of these conditions are often present in febrile cases, their not infrequent absence seems to indicate that none of them are absolutely essential to the production of pyrexia. A careful examination of the cases that occurred in our series

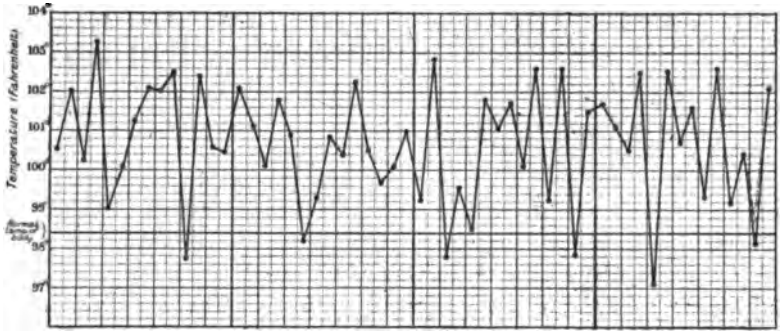


FIG. 33.—Chart of septicæmia arising from cancer of the stomach. (London Temperance Hospital.)

indicates that the temperature varies according to (*a*) the situation and character of the neoplasm, (*b*) the severity of certain symptoms, and (*c*) the presence of secondary inflammation in the peritoneal or thoracic cavity.

(*a*) In the following table we have arranged the cases according to the site of the disease and the character of the temperature. It will be observed that when the neoplasm involved the pylorus febrile symptoms were present in only 20 per cent., while in disease of the body of the stomach and of the cardia they existed in 58 per cent. and 37 per cent. respectively.

TABLE 27

Site of disease	No fever	Occasional fever	Constant fever
Pylorus	80%	11%	9%
Cardia	63%	12%	25%
Walls and curvatures .	42%	25%	33%

It has already been shown that morbid growths vary in character in different regions of the stomach, those which occupy the pylorus being often hard, contractile, and prone to superficial ulceration, while those situated upon the walls or curvatures of the organ are usually soft, rapidly growing, and liable to slough. It is possible, therefore, that the variations of temperature may depend as much upon the morphological peculiarities of the tumour as upon its situation. This suggestion is supported by the fact that while an elevation of temperature was only observed in 11 per cent. of the cases of scirrhus, nearly 53 per cent. of those described as medullary or adeno-carcinomata were accompanied by pyrexia. Of these latter cases, the great majority presented ulceration or metastases after death, but in

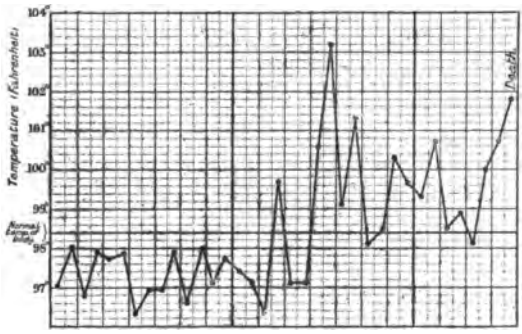


FIG. 34.—Chart in a case of carcinoma of the stomach which proved fatal from pneumonia. (London Temperance Hospital.)

8 per cent. the growth was not associated with any complication visible to the naked eye. It is therefore probable that the softer forms of carcinoma, like certain sarcomata, are often attended by moderate pyrexia as the result of an extreme activity of cell-growth.

(*b*) The symptoms which exert the most important influence upon the temperature are *dysphagia* and *vomiting*. In every case where the disease was accompanied by difficulty of swallowing the temperature showed the same tendency to depression that occurs in other forms of starvation, and for many weeks before death indicated a state of collapse. The antipyretic effect of excessive vomiting may be due partly to progressive inanition, and partly to the elimination of pyogenetic substances pro-

duced by the disintegration of the neoplasm. In our series fever was present in 53 per cent. of those where vomiting was rare or absent, but only in 9 per cent. of those attended by frequent attacks of emesis.

(*c*) Certain complications are usually accompanied by fever, especially inflammations of the peritoneum, pleura, and lung. In exactly one half of our cases where the temperature remained constantly elevated, recent peritonitis was found in the upper segment of the abdomen after death. In most instances this was due to malignant infection of the serous membrane, but in two perigastric suppuration had occurred from leakage through the base of the disease. Exudation into the pleura or acute pneumonia is often responsible for the pyrexia that develops during the last week of life (fig. 34).

(**10**) **The Saliva.**—As a rule the saliva presents no deviation from the normal either in quantity or appearance. Occasionally, however, the secretion is considerably increased or is unduly thick and glutinous. A large proportion of the slimy mucus which is vomited in the early morning consists of saliva that has been swallowed during the night. In every case of carcinoma of the stomach there is a great diminution of the sulphocyanide of potassium. During the early stages of the disease the decrease may not be very marked, but as soon as the general nutrition becomes seriously impaired the proportion of the salt steadily diminishes, and it finally disappears altogether. In cases of simple ulcer, on the other hand, the quantity is rarely reduced unless the disease is attended by excessive emaciation.

The production of sulphocyanide of potassium and its elimination in the saliva appear to depend upon three factors, viz. the rapidity of absorption, the integrity of the hepatic cells, and the secretory activity of the salivary glands. Thus, any condition which lessens the absorption of peptones, such as excessive vomiting, atrophy of the stomach and intestine, obstruction of the œsophagus, or deprivation of food, is always accompanied by a diminished elimination of the salt; and the same occurs, though in a lesser degree, in cases of obstruction to the portal circulation. The secretion of sulphocyanide of potassium, like that of urea, is dependent upon the metabolic activity of the hepatic cells. Chronic poisoning by such substances as lead, phosphorus, and arsenic, which retard the

functions of the liver, or such diseases as acute yellow atrophy and diffuse cirrhosis, which destroy the tissue of the organ, are always accompanied by a diminution in the quantity of the salt; while excessive salivation from mercury and continued fevers, which lead to functional disorder of the salivary glands, is productive of a similar result.

The main factor in the diminished production of the sulphocyanide in gastric carcinoma seems to be the impairment of digestion and absorption which results from the disease. It is, consequently, most noticeable in cases where the cardiac orifice is obstructed or vomiting is an urgent symptom. As an element in the prognosis we consider the total disappearance of the salt to be of the greatest importance, for we have never known a case to live for more than a month after this phenomenon had been observed. It is important, however, to remember that a patient who presents no sulphocyanide when seen for the first time, will often exhibit a renewed elimination of the salt when he is placed under more favourable conditions and treated by lavage and rectal feeding.

As a rule the quantity of sulphocyanide of potassium present in the saliva may be gauged with sufficient accuracy by comparing the colour produced by the addition of two drops of a solution of perchloride of iron (two drachms to the ounce) to the saliva of the patient with that of a healthy individual. For more accurate work we are in the habit of employing a tintometer the scale of which represents quantities of the sulphocyanide varying from ·05 to ·7 mgs. The patient is requested to produce as much saliva as possible for two minutes, and to each cubic centimetre of the secretion are added two drops of the solution of ferric perchloride. The mixture is then stirred with a glass rod and filtered through cotton-wool, after which it is compared with the tintometer scale.[1]

(11) **The Urine.**—The quantity of urine is invariably diminished. When the body of the stomach is the seat of disease, and pain is the principal symptom, the daily amount may exceed thirty fluid ounces; but if the orifices are involved or vomiting is severe, only about fifteen fluid ounces may be voided in the twenty-four hours. Both the colour and the

[1] *Vide* Samuel Fenwick, *The Saliva as a Test for Functional Diseases of the Liver*, 1887.

specific gravity are somewhat increased, and if numerous metastases are present in the liver an excess of urobilin may be observed (Tissier). An odour of acetone is often detected during an intercurrent attack of subacute gastritis, and the existence of diacetic acid may be demonstrated by the blood-red colouration which is produced by the addition of perchloride of iron (Jaksch). Oxybutyric acid is also occasionally found (Klemperer). Senator has shown that excessive putrefaction of the intestinal contents, with constipation, may be accompanied by the elimination of *indican*. A simple test for this substance consists in mixing equal parts of urine and strong hydrochloric acid in a stoppered bottle, and adding one drop of a solution of calcium hypochlorite and one cubic centimetre of chloroform. After shaking for a few minutes the indican is converted into indigo, which produces a deep blue colouration of the fluid.

Although chronic interstitial nephritis existed in 15 per cent. of our cases, *albuminuria* was observed in only 3 per cent. A large quantity of albumin is usually indicative of parenchymatous nephritis, infarction, or of secondary growths in the kidney. *Peptonuria* has been observed by Maixner and Parganowski. By the former it was attributed to a loss of functional activity on the part of the gastric mucous membrane, and by the latter to the production of peptone by the disintegration of the cancerous growth.

The quantity of *urea* which is excreted varies considerably. During the early stages of the complaint, and in cases that pursue an acute course, the daily output may be increased owing to the rapid wasting of the tissues; but with the progress of inanition the amount gradually diminishes, until it may average only twenty to twenty-five grammes in the twenty-four hours. The diminution is much greater when the pylorus or the cardiac orifice is obstructed, for in such cases the total may not exceed ten to fifteen grammes. Rommelaere believes that the elimination of less than twelve grammes of urea *per diem* by a patient who suffers from chronic indigestion is pathognomonic of gastric cancer; but the researches of Robin, Kirmisson, and Deschamps have shown that a similar diminution of the salt may accompany non-malignant affections of the stomach. It is permissible, however, to assume that carcinoma *does not exist* in a case where the daily quantity of urea exceeds thirty grammes.

As a rule the chlorides are greatly diminished, and this fact is regarded by Jaccoud as one of great clinical importance. It is probable, however, that the percentage amount of chlorides in the urine does not depend so much upon the existence of carcinoma as upon the degree of inanition with which it is attended. Thus, Bouveret has observed an excess of these salts when the body of the stomach was affected without obstruction of the orifices, while in cases which suffered from excessive vomiting or extreme dysphagia less than one gramme was often voided in the course of the twenty-four hours. It may also be noted that in many cases of hypersecretion secondary to chronic ulcer the total quantity of chlorides is reduced to a still smaller figure. An excess of ethereal sulphates is occasionally present when cancer of the pylorus has given rise to great dilatation of the stomach.

(12) **Nervous Symptoms.**—Paralysis affecting the face or one side of the body was observed in 2 per cent. of our cases, and was caused either by ordinary cerebral hæmorrhage, a metastatic growth in the brain, or by thrombosis of the basilar or middle cerebral arteries.

Insomnia is a frequent cause of complaint, especially towards the termination of the disease, and may be attributed partly to nocturnal attacks of pain, and partly to the cerebral anæmia that ensues from the general malnutrition. The delirium which is sometimes observed during the last few weeks of life is also probably due to the latter condition.

In contrast to the optimism displayed by the subjects of tuberculosis, mental depression is an invariable feature of gastric carcinoma, and usually induces the patient to take a serious view of his complaint long before the development of special symptoms suggests to his medical attendant the possible existence of malignant disease. Persons who possess an hereditary predisposition to phthisis or mental disorders not infrequently develop actual melancholia or suffer from delusional insanity. We have known several cases where the mental aberration was so pronounced as to necessitate the employment of special attendants or removal to an asylum. If these phenomena appear at an early stage of the disease, they often mask the gastric affection and occasion serious errors of diagnosis. Excessive pain accompanied by insomnia sometimes induces attempts at suicide. The occasional development of

tetany and spinal paralysis will be discussed among the complications of the disease.

Certain cases, and especially those where the growth is extensive, the anæmia profound, and vomiting an infrequent symptom, exhibit a peculiar form of *coma* during the final phase of the disease. This phenomenon, to which the term 'coma carcinomatosum' has been applied, was first described by Petters and Kaulich, and later by V. Jaksch, Riess, and Senator. According to our experience it is usually preceded by rapid failure of strength, disappearance of appetite, a fall of temperature, and occasionally by severe retching and vomiting. The patient lies motionless in bed and in a state of profound lethargy, from which he can at first be temporarily aroused, but which is soon transformed into genuine coma. In this condition the breathing is quickened, and is characterised by deep inspirations, followed by long sighing expirations. The pulse is small and of low tension, and varies in frequency from time to time. The pupils are slightly dilated, the tongue is dry and often covered with aphthæ, and the surface of the body is cold and blue. The urine is retained, and the quantity secreted is greatly diminished. Occasionally the sweet smell of acetone may be recognised in the breath. Slight attacks of convulsions are sometimes observed. The duration of the coma varies from twenty-four hours to several days, but after it has become profound life is seldom prolonged more than three days. In those cases which display an extreme somnolence rather than actual coma, the patient may continue in a lethargic state for ten days, or even longer, provided that the warmth of the body and the nutrition are satisfactorily maintained. In one instance which came under our care the patient remained unconscious and unable to swallow food for seventeen days. Death usually occurs quite suddenly from failure of the respiration.

The great similarity between this form of coma and that which attends diabetes seems to indicate that it also arises from auto-intoxication. The acetone smell in the breath and the occurrence of oxybutyric acid in the urine in both forms of coma are of special interest.

(13) **Œdema.**—The lower extremities frequently become œdematous during the last month or two of life, either from gradual failure of the circulation or from pressure of ascitic fluid or a growth upon the inferior vena cava. When only one

limb is affected the cause is to be found in venous thrombosis. General anasarca usually indicates secondary inflammation of the kidney, but occasionally it exists without albuminuria or other signs of renal disease, and may be associated with ascites and hydrothorax. Chesnel has collected twelve instances of this interesting condition, and attributes it to an alteration in the composition of the blood.

CHAPTER V

PHYSICAL SIGNS

THE general aspect of a person suffering from carcinoma of the stomach is often highly suggestive of the nature of his complaint. When pain has been a prominent symptom the thin pinched face, the pursed-up mouth, and the permanent furrow at the root of the nose between the eyebrows convey to the mind an impression of constant suffering; while the sallow skin, the sunken cheeks, and the hollow temples so frequently seen in cases of pyloric stenosis indicate an impairment of nutrition that is rarely met with except in malignant disease of the stomach. In addition to this, the briskness of movement, the activity of thought, and the energy of expression usual in a man in the prime of life are replaced by a feeble gait and a listless demeanour, which show that every effort has become a toil, and that a sense of extreme weariness prevents the patient from taking any interest in the daily affairs of life. The despondency and minuteness of detail with which he discusses the most trivial features of his dyspepsia also strike the imagination as being out of proportion to the apparent seriousness of the complaint, and should serve to warn the most careless clinician of the existence of something more grave than a mere functional disturbance of digestion.

Although anæmia is invariably present, certain cases exhibit a curious patch of colour upon either cheek, which stands out in marked contrast to the yellowish pallor of the surrounding skin. This is due to the development of a capillary plexus over the malar bones, which gradually increases in size until it forms a large network of crimson-coloured vessels. According to our experience the phenomenon is chiefly encountered in cases where the malignant growth has involved the glands and tissues behind the stomach, and seldom occurs before the sixth month of the illness. The fact that the semilunar ganglia are frequently

embedded in the neoplasm seems to indicate that sympathetic irritation is the cause of the dilatation of the superficial vessels.

INSPECTION OF THE ABDOMEN

Careful inspection of the abdomen seldom fails to reveal important information, while not infrequently the facts which it imparts are of the utmost possible value. In order to obtain the best results the patient should lie upon his back with the occiput in contact with the mattress and the light thrown upon the body from the side opposite to the observer. The mouth should be open, and he should be directed to breathe easily and fully. No talking ought to be allowed, and no attempt should be made to raise the head, since it produces a contraction of the abdominal muscles, which greatly alters the appearance of the parts. In every case attention should be directed to the following points: (*a*) The general shape of the abdomen, (*b*) the position and size of the stomach, (*c*) the existence of visible peristalsis, (*d*) the presence of a tumour, (*e*) dilatation of the superficial veins, (*f*) retraction of the navel.

(*a*) *Shape of the Abdomen.*—The loss of the omental and subcutaneous fat that occurs at an early period of the complaint gives the skin of the abdomen a loose appearance, as though it were too voluminous, and in stout persons who have wasted rapidly lineæ atrophicæ may often be observed in the hypogastrium and the flanks. General distension is usually a sign of ascites, but occasionally it ensues from gaseous inflation of the intestine owing to obstruction of the colon.

(*b*) *Situation of the Stomach.*—The normal stomach occupies the left hypochondrium and epigastrium, and with the transverse colon produces a slight protuberance of the abdomen above the umbilicus. When the organ is much dilated it tends to become displaced by its own weight, and occupies the umbilical or even the hypogastric region. In these circumstances inspection reveals a sulcus or depression across the epigastrium, with a swelling at or below the level of the navel. The degree of gastroptosis varies according to the position of the pylorus, being comparatively slight when adhesions exist between it and the liver, but usually very pronounced if the tumour is not attached to the surrounding viscera. In the latter case the pylorus becomes dislocated downwards and to

the left by the weight of the enlarged stomach, and in two of our cases was found after death to be adherent to the uterus in the pelvis (fig. 44).

(*c*) *Visible Peristalsis.*—Under normal circumstances the stomach is invisible; but if its walls are thickened from hypertrophy of its muscular coat, and the abdominal parietes are attenuated, each contraction of the viscus can be seen as an undulating swelling, which slowly traverses the surface of the abdomen from left to right. The movements occur spontaneously and in rhythmic sequence after every meal, and may be excited at any time by rubbing the abdominal wall or by the application of ice to the skin of the epigastrium. The frequency and force of these contractions vary under different conditions, being feeble and intermittent when the stomach is empty or its tissues abnormally thin, but extremely conspicuous and practically incessant when the hypertrophied organ is endeavouring to force its contents through an obstructed pylorus. It may be observed that, unlike visible peristalsis of the colon, the movements of the stomach are not accompanied by pain.

(*d*) *Tumour.*—In addition to the swelling formed by an enlarged and dislocated stomach, the morbid growth itself often gives rise to a tumour which is visible to the naked eye. This is especially the case when the pylorus is the seat of the disease, but a large neoplasm of the inferior curvature, of the anterior wall, or of the omentum may be also easily detected. On the other hand, growths which affect the lesser curvature are seldom visible except on deep inspiration or after the stomach has been artificially distended, while those that occupy the cardia are effectually hidden beneath the sternum and ribs.

(*e*) *Enlarged Veins.*—Owing to the pressure it exerts upon the inferior vena cava, a dilated stomach is frequently accompanied by enlargement of the superficial veins of the abdomen. As a rule the condition is symmetrical and chiefly affects the superficial epigastric and superficial circumflex iliac veins, which may be traced upwards along the sides of the abdomen and chest, where they form numerous anastomoses with the branches of the intercostal, internal mammary and superior epigastric veins. In other cases all the superficial venules of the lower abdomen, the back and upper parts of the thighs are uniformly dilated.

(*f*) *Retraction of the Navel* ensues from cancerous infiltration of the round ligament or of the subperitoneal tissue immediately subjacent to it, and is, consequently, a sign of considerable importance. Occasionally the umbilicus exhibits superficial excoriation, or one or two nodules of new growth may be detected in the subcutaneous tissue in its vicinity.

EXAMINATION OF THE STOMACH

This includes the investigation of the size and capacity of the organ, of its secretory and motor functions, and of the microscopical characters of its contents.

Size and Position.—In addition to the general information derived from inspection it is necessary to have recourse to some special method whereby the size and location of the viscus may be accurately determined. Of the various methods in vogue, only those of auscultatory percussion, artificial inflation, and electric illumination require special mention.

Auscultatory Percussion.—This is performed in the following manner. Half a pint or more of effervescent soda-water is administered to the patient, with the view of procuring moderate distension of the stomach, and he is then directed to lie upon his back with the shoulders and head slightly raised. The examiner places the end of a stethoscope over the epigastrium, and then makes a series of sharp taps with the index finger of the right hand upon the abdominal wall along lines which radiate from the point of auscultation. As long as percussion is made over a spot where the stomach is in contact with the parietes of the abdomen the shock conveyed to the ear is of the same intensity; but immediately the finger travels off the gastric area the sound becomes faint and toneless. The points at which this change takes place are marked on the skin with a blue pencil, and the investigation is continued in all directions until the entire outline of the viscus is mapped out on the skin. This method is not only very accurate in its results, but is also easy to perform, and does not entail any discomfort to the patient. The only point which requires special attention is the application of the stethoscope immediately over the stomach.

Artificial Inflation.—This may be performed in two ways: either by the administration of chemical substances which

generate gas when mixed together, or by forcibly pumping air into the organ. Inflation by carbon dioxide is a very old procedure (Wagner, 1869), which has recently been again brought into fashion by Riegel and Boas. Forty to sixty grains of bicarbonate of sodium and thirty to forty grains of tartaric acid are each dissolved in about eight ounces of water contained in separate glasses. The patient first drinks the acid, and then the alkaline solution, and is directed not to eructate any gas. The interaction of the two substances causes a rapid evolution of carbon dioxide, which distends the stomach to its utmost capacity and causes its outlines to become visible upon inspection of the abdomen. In the second method a soft tube is introduced into the stomach, and air is either pumped in by a hand bellows or blown in by the mouth until the organ is sufficiently distended to be apparent. Gaseous inflation of the stomach, although often a valuable aid in diagnosis, is not devoid of danger, as the upward displacement of the diaphragm which it occasions is apt to embarrass the action of the heart and to produce syncope. When the pylorus is incompetent and the walls of the stomach rigidly infiltrated, the gas often escapes into the intestine without producing distension of the viscus. Hemmeter prefers to use a rubber bag made in the shape of the stomach, which is introduced at the end of a soft tube and can be inflated in position. By allowing the air to escape into a spirometer the capacity of the stomach may also be gauged.

Trans-illumination (*Gastrodiaphany*).—Einhorn has invented a method of illuminating the stomach by means of a small electric lamp fixed in the eye of a tube. After the organ has been washed out the patient drinks a pint of water and the instrument is passed into the stomach. The viscus transmits the light through the abdominal walls and becomes visible as a red zone. According to our experience gastrodiaphany is of very little value, although it is highly spoken of by some American writers.

Exploration with a Tube.—By the employment of a soft tube it is possible to determine (1) the existence of an obstruction to the entry of food; (2) the motorial activity and general capacity of the stomach; (3) the chemical characters and digestive properties of the gastric secretion; (4) the presence of blood, bile, micro-organisms, and of particles of new growth.

(1) Carcinoma of the stomach is accompanied by pain and difficulty of deglutition whenever the disease involves the cardiac orifice or extends into the œsophagus. In such cases the employment of a soft tube not only will determine the existence and site of the obstruction, but will often afford valuable information concerning the condition and character of the growth. In order to obtain the best results the tube should be of moderate size, with an opening about one inch from its point, and should be graduated externally in inches or centimetres. The instrument is gently inserted until its progress is firmly arrested, when the scale at the level of the incisor teeth is read off and recorded. The patient is then made to cough several times, so as to drive any material that may exist above the stricture into the interior of the tube, after which the free extremity is firmly closed with the finger and the instrument quickly withdrawn. Since the average distance between the incisor teeth and the cardiac orifice in an adult man is 16–18 inches (40–47 cms.), the site of the obstruction is readily determined by reference to the scale of measurement; but it must always be borne in mind that a stomach which is contracted by diffuse cancerous infiltration may also prevent the insertion of a tube beyond eighteen inches. The quantity of material extracted varies, according to the severity of the stenosis, from one drachm to two fluid ounces or more, and usually consists of milk or undigested food mixed with mucus and saliva. In reaction it is neutral or alkaline, and it exhibits no digestive power upon egg albumin after acidification with hydrochloric acid. If the morbid growth is ulcerated a small quantity of grumous matter or bright blood may be present, while occasionally the material possesses a disagreeable or fetid odour indicative of sloughing of the neoplasm. On microscopical examination particles of food, epithelial cells, torulæ, cocci, and bacteria can always be detected, and in some instances blood or pus cells and even fragments of the growth may be recognised.

(2) In its normal state the stomach in the early morning either is empty or at most contains only one or two cubic centimetres of an acid mucoid fluid, while its motor activity is sufficient to dispose of a full meal within seven hours. Should the pylorus be contracted, however, or the muscular coat of the organ be too feeble to perform its accustomed functions, the food will

remain in the stomach for a much longer period. It is therefore advisable in every case to conduct the first investigation in the early morning, when no food has been taken for at least twelve hours. As soon as the instrument has been inserted into the stomach the patient is made to compress the abdomen with his hands and to cough vigorously, when the rise of intragastric pressure causes the evacuation of any material the organ may contain. Should these measures fail to procure the desired result, the nozzle of a glass syringe may be attached to the end of the tube and siphonage started by means of suction. In every case of gastric cancer accompanied by enfeeblement of the muscular coat of the organ a certain amount of undigested food may be extracted in this manner, while in pyloric obstruction the quantity sometimes exceeds two pints. The phenomenon of food stagnation which is thus demonstrated not only establishes the existence of gastrectasis, but constitutes a rough indication of the degree of dilatation of the stomach. This conclusion may be further confirmed by the detection of some article of diet, such as beans, peas, grapestones, or other vegetable matter, which had been eaten by the patient several days, or even weeks, previously.

(3) In order to obtain the most reliable information concerning the state of the gastric secretion, it is necessary to examine the contents of the viscus at the height of digestion rather than during the period of food stagnation. For this purpose the organ is washed out in the early morning, and afterwards the patient partakes of a test meal composed of half a pint of weak tea and a thick slice of bread and butter. At the end of an hour the tube is again passed and the semi-digested material extracted. It may usually be observed that the quantity of liquid obtained in this manner equals or even exceeds the amount administered, and that the bread shows little or no signs of digestion. There is also a large excess of mucus, which renders filtration through paper such a tardy process that it is generally advisable to strain through well-washed butter-muslin. In almost every instance the filtrate is acid in reaction, although when triturated with the decinormal solution of soda its total acidity is found to be much reduced.

Free Hydrochloric Acid.—The first investigations upon this subject were conducted by Golding Bird in 1842, who summed up a series of most admirable researches by the state-

ment that 'the matter brought up (*i.e.* vomited) contains considerable quantities of free hydrochloric acid during the more irritative stage of the disease, which gradually decreases in proportion to the decrease in strength, while the organic acids increase in proportion to the decrease of free hydrochloric acid.' The complicated method of analysis employed by Golding Bird was probably responsible in great measure for the neglect with which the subject was treated, for it was not until 1879, when v. den Velden published his observations upon the absence of hydrochloric acid in cancer of the pylorus, that the profession realised the important bearing of the discovery upon diagnosis. Immediately this essay appeared the subject was ardently taken up by Riegel, Ewald, Huebner, Honigmann, Thiersch, Jaworski and Gluczynski, Kahn and v. Mering, Rosenbach and others, who not only confirmed the general statements of v. den Velden, but went so far as to declare that an absence of free hydrochloric acid constituted an almost infallible sign of carcinoma of the stomach. Like most other scientific conclusions that are formulated in haste, this one was duly repented of at leisure, for it was soon shown not only that certain cases are accompanied by the free acid throughout their entire course, but that other diseases occasionally exhibit a similar diminution of the acid secretion. Thus Ewald, Kahn and v. Mering, Stéinon, Rosenheim, Bouveret, Waetzoldt, and other observers have recorded examples of gastric cancer in which the free acid not only persisted, but was present in excess; while its total disappearance has been observed in atrophic gastritis, achylia gastrica, lardaceous degeneration of the stomach, certain infectious fevers (Wolfram), Addison's disease (Köhler), pernicious anæmia, Bright's disease, and many cases of phthisis (Rosenthal, Fenwick). We find that out of a total of 495 cases of gastric carcinoma, published by various authorities, where the contents of the stomach were carefully and systematically examined, free hydrochloric acid was *absent in* 89 *per cent.*, and present in small quantities or at irregular intervals in 9·7 per cent., while in 1·3 per cent. it existed in excess. This conclusion tallies very closely with our own observations, which indicate that the colour tests for free hydrochloric acid give a negative reaction in 91 per cent. of all cases of the complaint.

Numerous tests have been proposed for the detection of free hydrochloric acid, but only two need be described.

(1) *Dimethyl-amido-azo-benzol* was introduced by Töpfer on account of its delicacy and ease of application. In the form of a ·5 per cent. solution in alcohol it possesses a golden-yellow colour, which instantly changes to cherry-red when brought into contact with the free acid. This reaction is readily observed by allowing a drop of the contents of the stomach to mingle with a small quantity of the solution upon a porcelain dish, when the characteristic colour is seen to develop at the junction of the two fluids.

(2) *Phloroglucin and vanillin* dissolved in alcohol was first recommended by Günzberg as a convenient test for the presence of the free mineral acid, and has attained a world-wide popularity. In order to obtain the best results two grammes of phloroglucin and one gramme of vanillin are dissolved in 100 grammes of absolute alcohol, and the solution is preserved in a black well-stoppered bottle, as it is soon decomposed if exposed to the light (Boas). A few drops are mixed in a white china dish with an equal quantity of the filtered gastric contents, and gently warmed over a spirit lamp. If free hydrochloric acid is present, a beautiful rose colour will develop at the spot where the mixture dries. If too much heat is applied, a brownish-red tint is produced, even in the absence of the acid.

The diminished quantity of hydrochloric acid in carcinoma of the stomach was originally attributed by Riegel to its neutralisation by the alkaline secretions of the morbid growth, while according to Ewald the phenomenon was dependent upon failure of the general nutrition. These theories, however, were easily disproved, and it is now known that the failure of the secretion depends upon secondary inflammation and atrophy of the gastric glands. Thus Mathieu and Rosenheim have shown that in every case where free acid is absent during life the stomach presents signs of chronic inflammation, with a disappearance of the parietal cells and sometimes atrophy of the entire gland. This condition is a permanent one, since the acid does not reappear even after removal of the growth (Mintz).

These facts serve to explain the more uniform absence of free acid when the pylorus is involved than in those cases where the tumour is comparatively circumscribed and affects the walls or curvatures of the stomach, for it has already

been shown that chronic gastritis is usually due to retention of the food and irritation of the gastric mucous membrane by the acid products of fermentation.

The continued existence of free acid along with carcinoma is chiefly met with under two conditions: (1) A small growth situated upon a wall of the stomach, (2) cancerous invasion of a simple chronic ulcer or its scar. In the former case the disease is more or less circumscribed, gastrectasis is slight, and, with the exception of that in the immediate vicinity of the tumour, the mucous membrane of the stomach is practically free from inflammation. In the latter condition hyper-secretion has usually existed for a considerable period of time, and the signs of it do not disappear until the morbid growth has given rise to a diffuse gastritis.

It is never sufficient to rely upon an absence of the acid in a single examination, but in every case the investigation should be repeated under similar conditions at least three times. This is especially important when the first attempt has been made without antecedent lavage or the administration of a test meal, for we have more than once noted a reappearance of the free acid after the stomach had been thoroughly cleansed for a few days and the patient fed by rectal injections. When these several precautions are adopted the continued absence of free hydrochloric acid constitutes valuable confirmatory evidence of the existence of a morbid growth.

The secretion of hydrochloric acid is seldom entirely abolished, since it can usually be detected in a combined state by means of appropriate tests; while according to Schüle the determination of the total deficit is of much importance in the differential diagnosis of carcinoma and benign affections of the pylorus. Inasmuch, however, as the total amount of acid is often greatly reduced in atrophic gastritis and other diseases of the stomach, the value of the information obtained from a quantitative estimation is rarely commensurate with the labour expended upon it.

Lactic Acid.—It was formerly the custom among German writers to describe a stage of normal digestion which was characterised by the production of lactic acid. The experiments upon which this view was founded appear, however, to have been falsified by the accidental introduction of lactic acid with the bread of the test meal, and consequently the elaborate

theories that were formulated to explain the development of the organic acid have ceased to be either useful or interesting. Boas was the first to call attention to the existence of an excess of lactic acid in stomachs affected by cancer, and subsequent investigations have confirmed his statement upon this point. Like the absence of free hydrochloric acid, the presence of lactic acid is by no means invariable, and it is interesting to observe that in those exceptional cases where the free mineral acid is present the organic acid is usually absent. Among 109 cases collected by Schiff in which lactic acid was found during the period of digestion, the stomach was affected with carcinoma in ninety-two, or 84·4 per cent.; while among 268 cases of malignant disease of the organ, lactic acid was shown to exist in 197, or 73·5 per cent. Strauss noted its presence in 91 per cent., Rosenheim in 78 per cent., Lindner and Kuttner in 60 per cent., Hemmeter in 82 per cent., and Osler and McCrae in 75·3 per cent. of the cases they examined. According to our experience, it is present in about 91 per cent. of the cases where the pylorus is the seat of the disease, and in 57 per cent. of those in which the growth affects the cardia or a circumscribed area of the organ.

The conditions which bring about an excessive formation of lactic acid in the stomach are: (1) Stagnation of the food; (2) a deficiency of hydrochloric acid; (3) a diminished power of digestion and absorption of proteids. In cases of gastric cancer, and especially in those where there is stenosis of the pylorus, all these conditions are present, and consequently malignant disease is more often associated with lactic acid fermentation than any other affection. It is important to remember, however, that the same requirements are sometimes fulfilled by other lesions than carcinoma of the stomach, such, for example, as benign stenosis of the pylorus accompanied by atrophic gastritis, or partial occlusion of the lower duodenum by a malignant growth or the pressure of a tumour. While, therefore, the discovery of lactic acid in the gastric contents cannot be considered as pathognomonic of carcinoma of the stomach, its existence along with other symptoms and signs of the complaint must be regarded as confirmatory evidence of the disease.

Many elaborate processes have been invented by which lactic acid may be detected and its quantity estimated, but their value as an aid to diagnosis is extremely doubtful. All

that is required is some method, easy of application, by means of which the substance can be recognised when present in excess. This simple qualification is amply fulfilled by the test proposed by Ueffelmann, which consists in mixing 10 c.c. of a 4 per cent. solution of carbolic acid with 20 c.c. of water containing one drop of a strong solution of perchloride of iron. The mixture presents an amethyst-blue colour, which changes to canary-yellow on the adddition of lactic acid. The delicacy of the reaction is destroyed by the presence of free hydrochloric acid, and a somewhat similar colouration is produced by glucose, phosphates, and alcohol. If any doubt exists as to the result of the test, a small quantity of the filtered gastric fluid should be thoroughly shaken with ten times its volume of pure ether, and allowed to stand until the fluids separate from one another. The ethereal portion of the mixture is then siphoned off and gently evaporated, and the residue is dissolved in distilled water and tested for lactic acid as in the previous case.

In rare instances the contents of the stomach extracted one hour after a test meal are found to be neutral or alkaline, and to contain neither lactic nor hydrochloric acid. This absence of acidity neither supports nor negatives the existence of carcinoma.

Secretion of Pepsin and Rennet.—The digestive power of the gastric juice is always greatly impaired by a deficiency of hydrochloric acid, although it is now accepted that, so long as the stomach is able to absorb peptones, a combination of pepsin and lactic acid is sufficient for the digestion of proteids. In every case the filtered contents of the stomach, when acidulated with hydrochloric acid, exhibit marked digestive properties, and if lavage is performed with a 0·2 per cent. solution of the mineral acid the resultant fluid will readily dissolve egg albumin at the temperature of the body. Although the results have no particular value from a clinical standpoint, the quantity of pepsin secreted by the stomach may be determined by the following method, devised by Hammerslag: 10 c.c. of a 1 per cent. solution of egg albumin, containing free hydrochloric acid to the amount of 0·4 per cent., aro placed in an Esbach albuminometer, and to them are added 5 c.c. of the gastric filtrate to be examined. A second albuminometer is filled with 10 c.c. of the standard solution of egg albumin and hydrochloric acid, and both tubes are allowed to remain in an incubator at a temperature of 98° F. for an hour. At the end of this time the amount of albumin

in each is determined by the Esbach reagent, when the activity of the pepsin in the gastric filtrate may be roughly gauged by observing the difference in the amount of precipitated albumin in the two tubes.

According to Boas, the rennet ferment usually persists after the disappearance of hydrochloric acid, but this fact has little clinical significance. Its existence in the gastric contents may be determined by neutralising 5 c.c. of the latter with carbonate of sodium and adding an equal quantity of milk. After standing for fifteen minutes in a warm place a firm coagulum of casein will be found to have formed if rennet was present in the gastric fluid.

Microscopical Examination of the Contents of the Stomach. *Micro-organisms.*—In addition to various kinds of undigested food, vast quantities of torulæ and other fungi may usually be observed in the residue upon the filter. It was formerly believed that the presence of sarcinæ was indicative of cancer of the pylorus; but it is now known that, far from being pathognomonic of the complaint, they occur quite as often in cases of benign stenosis as in malignant disease. Of greater importance are the so-called Oppler-Boas bacilli. These are long, rod-shaped, non-motile organisms, which are often thicker at one end than the other, and can easily be recognised in stained cover-slip preparations. Like many other fungi met with in the stomach, they excite lactic acid fermentation of carbohydrates, and consequently often exist in enormous numbers when the organ is affected by a neoplasm. They were observed in nearly 90 per cent. of the cases of gastric cancer examined by Oppler, Kauffmann and Schlesinger, Riegel, and Hemmeter and Adler.

Fragments of Tumour and Cancer Cells.—It has already been remarked that during the process of disintegration fragments of the growth are apt to become detached, and may be occasionally recognised in the vomit. Several cases have come under our own observation where the discovery of pieces of new growth in the ejecta served to confirm the diagnosis; and Mathieu has recently observed one in which three pieces of epitheliomatous tissue were eliminated in the vomit In most of these cases, however, the tumour has already reached a considerable size and is accompanied by such pronounced symptoms that its recognition is not attended by any difficulty.

On the other hand, there is reason to believe that even at an early period of the complaint minute conglomerations of cells, strips of mucous membrane from the vicinity of the growth, or isolated cells showing atypical mitoses, are often spontaneously detached, and may be recognised by a systematic examination of the gastric contents.

(*a*) Microscopic aggregations of cancer cells have been described by many writers, but they are not always easy to recognise, on account of the similarity that exists between them

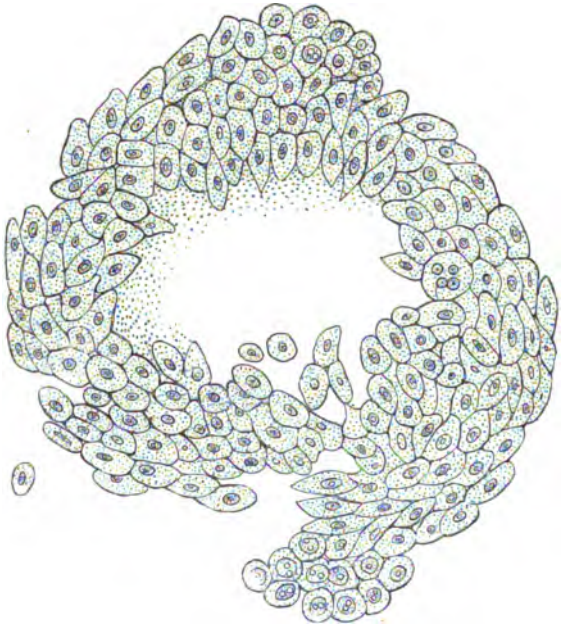


FIG. 35.—Drawing of a small mass of carcinomatous tissue expelled from the stomach. (Ewald.)

and the particles of epithelium that are habitually shed in cases of chronic gastritis. When, however, the cells present the appearance of concentric cell-nests, they constitute strong evidence of the existence of a neoplasm.

(*b*) In order to obtain shreds of mucous membrane or isolated cells from the stomach, certain precautions have to be taken. In the first place, the stomach should be empty at the time of the examination, since the presence of undigested food constitutes a formidable obstacle to their recognition. The

viscus should, therefore, be carefully washed out in the evening, and no food be permitted until after lavage on the following morning; while in some cases it may be necessary to perform the preliminary cleansing several times and to feed the

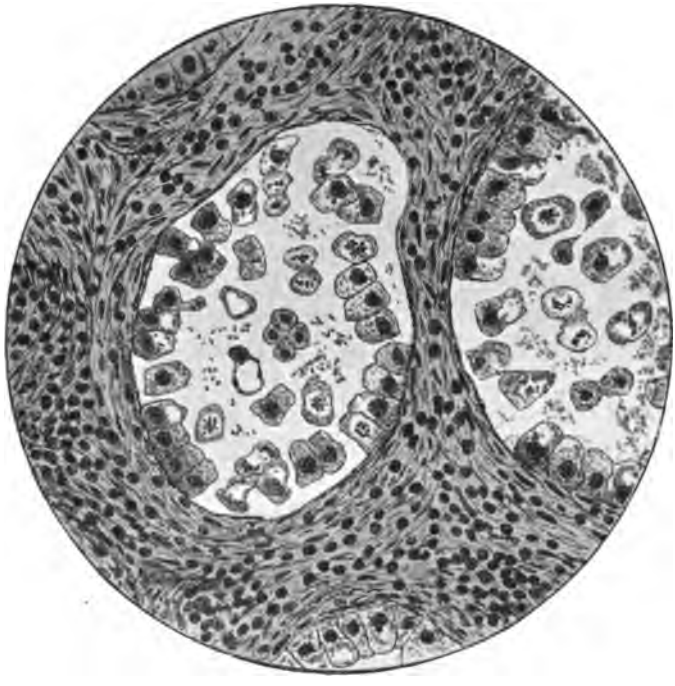


FIG. 36.—Fragment of gastric mucosa obtained by curettage, showing the lumen of two gland tubules. The interglandular connective tissue is thickened and permeated with small round-celled filtration. The greater portion of the epithelium of the gland is detached; many cells show vacuoles, some of them so large as to submerge the identity of the original cell, which appears either as a small rim of protoplasm around a vacuole or as a smaller mass at the side of a huge vacuole. Numerous gland cells are in the state of atypical mitosis. There are in both asymmetrical mitoses, some with disrupted chromosomes. In the centre of one lumen is a four-lobed cell presenting four nuclei. Asymmetrical mitoses do not derive their name from asymmetry in shape or configuration; an asymmetrical mitosis is one whose daughter-stars do not contain a like or even number of chromosomes. (Hemmeter.)

patient by the rectum for two or three days. As a rule a soft tube of medium calibre is sufficient for all purposes; but Hemmeter prefers one in which the terminal orifice is provided with sharp edges which can scrape or 'curette' the gastric

mucosa. About half a pint of warm normal saline solution is poured into the viscus through the tube, which is then alternately inserted to its full extent and partially withdrawn until its point has been brought into contact with the greater part of the mucous membrane. A second half-pint of saline solution is then introduced, after which the whole is rapidly siphoned off into a conical glass and allowed to stand for two or three hours. The sediment is then placed in a centrifugal machine and the ultimate deposit stained and examined by the microscope.

Shreds of mucous membrane may be obtained in this manner in most cases of subacute and chronic gastritis; but those which are met with in gastric cancer are stated to present two characteristic features: the peptic ducts are much elongated and dilated, and are separated from one another by an excess of connective tissue; while their cells are either partially or completely detached from the basement membrane, and exhibit karyokinetic figures of an asymmetrical form (figs. 37 and 38).

(*c*) Although atypical mitoses are common to all tissues which are undergoing rapid proliferation, their presence in cells derived from the stomach must be regarded as highly suggestive of a neoplasm. Rieder seems to have been the first to diagnose malignant disease of the peritoneum from the presence of a large number of cells displaying indirect division in the fluid withdrawn from the abdomen, and Dock was able to recognise cancer of the pleura and peritoneum in a similar manner. The cells present in the serous exudations in such cases were of various shapes and sizes, and frequently contained vacuoles large enough to displace or obscure the nucleus. Hemmeter, who has paid much attention to this subject, states that the forms of cell and nuclear division known as the equatorial plate and the monaster are frequently observed in the gastric cells obtained by lavage, and has published some diagrams (37 and 38) showing the various atypical mitoses that are encountered.

Palpation.—Palpation of the abdomen is a method of examination of the utmost importance. It should be performed, in the first instance, while the patient lies upon his back with his shoulders and head slightly raised and his knees bent over a pillow. The examiner stands or kneels on the right side of the couch, and gently and evenly slides his hand

from one part of the abdomen to another, without exercising any sudden or undue pressure with the fingers, which is apt to

FIG. 37

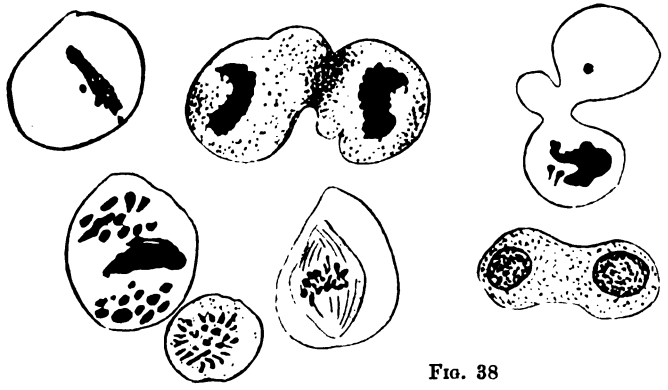


FIG. 38

Fig. 37 gives a number of cells in the state of atypical mitoses, taken from parts of the specimen illustrated in fig. 36. To the left side, below the centre, is a mitotic form showing a cell with a huge vacuole and three nuclei; directly opposite, on the right side of the illustration, is a similar smaller cell in which the protoplasm has surrounded a vacuole like a narrow ring. The lowest cell in the figure is an asymmetric mitosis, showing an uneven number of chromosomes and disrupted chromosomes. This is also shown in other cells of fig. 38, particularly in the cells showing a crippled pithode stage. The cells thus pictured were discovered lying detached in the lumen of the gland-ducts as shown in fig. 36. (Hemmeter.)

induce reflex contraction of the recti muscles of the abdomen. For a similar reason care must be taken that the hand is warm before it is applied to the skin. The patient ought not to be permitted to talk, unless it is necessary to distract his attention, and he should be directed to breathe easily and deeply, so as to maintain the stomach in constant movement. Each region is explored in turn, and if any difficulty is encountered in the palpation of the deep structures, the patient should be made to recline upon his left side with the head bent forwards, the knees drawn up, and the back resting against the left knee of the examiner. Sometimes it may be necessary to adopt the knee-elbow position. The points to which particular attention is directed are: (1) The existence of localised tenderness; (2) thickening of the linea alba and secondary deposits in the skin; (3) an abdominal tumour.

(1) *Local Tenderness.*—This is much less characteristic than in cases of simple ulcer. It chiefly exists over the site of the growth, and is especially noticeable when the disease has infected the omentum or some other neighbouring structure. As a rule, a rapidly growing tumour of the body of the stomach is more tender than a circumscribed scirrhus of the pylorus, and not infrequently the maximum pain is felt at some little distance from the centre of the mass, where the neoplasm is invading fresh tissue or has undergone ulceration. General tenderness over the region of the stomach may be observed in cases of pyloric stenosis where the viscus is inflamed and filled with gas, and in most of those in which the organ is affected by diffuse cancerous infiltration. Manipulation of a tumour is often followed by severe pain, which persists for several hours and is sometimes accompanied by vomiting.

Some writers have asserted that the pain of gastric cancer is often referred to certain areas of the skin which present an extreme degree of hyperæsthesia. According to Head, the stomach receives its sensory nerve-supply from the sixth, seventh, eighth, and ninth dorsal segments, the two former supplying the cardia and the last-named the pylorus; consequently, in cases of organic disease of the viscus cutaneous tenderness should exist in front from the level of the nipple to the umbilicus, and posteriorly from the fifth to the twelfth dorsal spine. Each area is also supposed to present certain specially tender points, those for the sixth dorsal area being

just below the nipple and at the angle of the scapula; those for the seventh near the tip of the ensiform cartilage and below the angle of the scapula; while for the eighth and ninth they are situated anteriorly in the nipple line and posteriorly below the inferior angle of the scapula. The same observer states that there are painful and tender areas upon the scalp which correspond to the dorsal cutaneous areas, the occipital region corresponding to the tenth dorsal and the parietal to the ninth. If these facts were correct they would obviously constitute a very valuable aid not only in the diagnosis of gastric disease generally, but in the exact location of an ulcer or a growth. Unfortunately, the results of clinical experience do not confirm the supposititious value of these statements, for although we have carefully examined several hundred cases of gastric disease, we have never been able to demonstrate either that cutaneous hyperæsthesia is a constant accompaniment of an ulcer or a growth, or that its situation corresponds in any way with the location of the lesion in the stomach. The only affection which, in our experience, is frequently associated with tender areas in the regions mentioned is subacute gastritis with flatulent distension of the stomach or colon, and even in this disorder they vary greatly in position at different periods of the day. As an indication of gastric carcinoma we regard superficial tenderness as not only valueless but absolutely misleading.

(2) *Metastases in the Abdominal Wall.*—The occasional development of secondary deposits in the skin of the abdomen has long been recognised, although their importance has not been sufficiently appreciated. They may occur in the form either of an induration of the linea alba (Catteau, Villar, Legg), or of small rounded tumours situated in the subcutaneous tissue. The former condition is detected upon palpation as a hard fixed and cord-like thickening, which extends from the ensiform cartilage to the navel and occasionally reaches thence to the pubes. When the round ligament is infiltrated by the new growth the umbilicus is usually retracted, the skin around it is adherent, and its surface is uneven, red, or excoriated; but in those cases where the median induration is due to cancerous invasion of the linea alba and of the subjacent connective tissue the navel often remains unaffected. In the former case the peritoneum usually exhibits secondary growths, and the linear thickening only extends as far as the

umbilicus, but in the latter the serous membrane may be quite free from disease. In many thin but healthy persons a somewhat similar cord can be felt, owing to the abnormal size of the fœtal remains which exist in the central line of the abdomen, but it never extends the entire distance from the ensiform cartilage to the symphysis pubis.

Superficial Metastases are met with in about 2·3 per cent. of all cases of gastric carcinoma. They are usually situated at or near the umbilicus, where they form small hard rounded tumours, which in the course of development tend to become adherent to the skin and occasionally ulcerate. Less frequently several discrete nodules appear in the subcutaneous tissue near the median line, or in the linea semilunaris, which consist of minute omental herniæ that have become infected by the new growth. Finally, in rare instances the whole of the abdomen, chest, and back is beset with small movable subcutaneous tumours, which vary from the size of a millet-seed to that of a pea, and exhibit a rapid increase of size; even the muscles may be affected (Merklen). In one case of this kind that came under our notice more than three hundred nodules were scattered over the trunk; and in a similar instance recorded by Finlay the diagnosis of cylinder-celled cancer of the stomach was made from the microscopic appearances presented by one of the tumours after its excision.

(3) *Abdominal Tumour.*—Tumours of the stomach vary so much in character, according to their situation, that in order to interpret their clinical significance aright it is necessary to bear in mind certain facts in connection with the position and relations of the normal stomach.

The adult stomach is situated in the left hypochondrium and epigastrium, with its long axis directed downwards and to the right. The median line of the body intersects the pyloric region in such a manner that nearly five-sixths of the organ lie in the left half of the abdomen (Luschka). The cardiac orifice is situated behind the seventh left costal cartilage, at its junction with the sternum, and is covered by the left lobe of the liver. The highest part of the viscus is the upper margin of the fundus, which reaches to the level of the fifth rib. The lesser curvature descends perpendicularly along the left side of the spinal column to the first lumbar vertebra, where it crosses abruptly to the right to terminate at the pylorus. When the

stomach is empty the pylorus corresponds to the inner end of the eighth right cartilage just outside the parasternal line; but when the viscus is distended it may move two or three inches to the right of a line drawn from the tip of the ensiform cartilage to the umbilicus, while at the same time the great curvature comes nearer to the abdominal wall and the anterior surface looks more upwards. The lower border of the organ is very variable in its position, even in persons who enjoy perfect health, but as a rule it reaches as far as a line drawn between the cartilages of the ninth ribs.

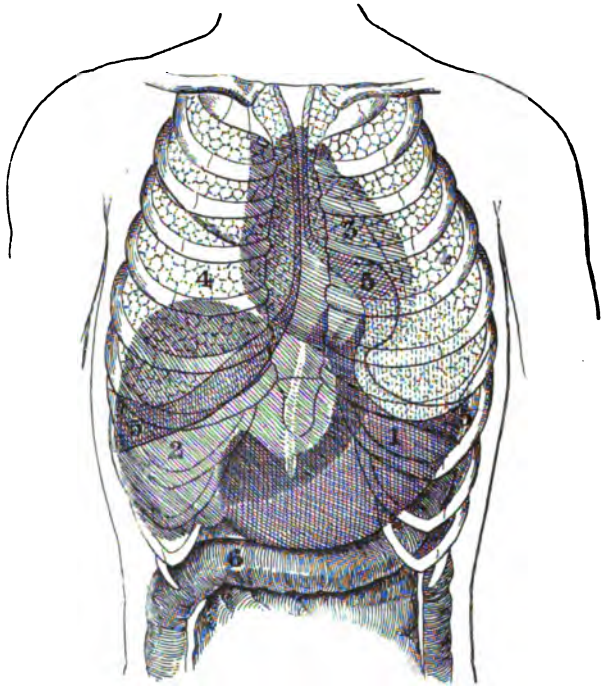


FIG. 39.—Situation of the normal stomach. 1, stomach; 2, liver; 3, heart; 4, lungs; 6, transverse colon. (Eichhorst.)

These facts indicate that only the lower halves of the pyloric and central thirds of the stomach come into contact with the anterior abdominal wall, and that, consequently, only those growths which are situated in these regions are invariably palpable. On the other hand, tumours of the cardia, of the fundus, or of the posterior gastric wall, are rarely felt until they have attained a considerable size or have occasioned dis-

location of the stomach; while those of the pylorus, by developing adhesions to the under surface of the liver, are also apt to escape detection.

General Characters of the Gastric Tumour.—(*a*) *Frequency.* According to the statistics of Brinton and Lebert, nearly 80 per cent. of all carcinomata of the stomach are accompanied by a palpable tumour. Osler and McCrae detected a tumour in 76 per cent. of their clinical cases, while in our own series a definite tumour was discovered in 69 per cent. and an 'ill-defined tumour' or a 'sense of resistance' was recorded in 8 per cent. In the remaining 23 per cent. no evidence of a growth could be found by examination of the abdomen during life. It must, therefore, be admitted that a palpable tumour only exists in four out of every five cases of carcinoma of the stomach. As might have been expected from the anatomical relations of the stomach, the discovery of a tumour varies with the situation of the disease. Thus, in our series 81 per cent. of those which were situated in the body of the stomach were detected during life, of the pyloric growths 71 per cent., and of those located at the cardia or in the fundus only 55 per cent. It is also interesting to notice the conditions which seem to have been chiefly responsible for the non-detection of the tumour. Thus, among fifty cases in which no tumour was discovered during life—

The abdomen was distended with fluid in nineteen, or 38 per cent.

The growth was situated deeply (cardia, fundus or posterior wall) in fifteen, or 30 per cent.

The tumour was very small in ten, or 20 per cent.

Excessive tenderness prevented deep palpation in six, or 12 per cent.

(*b*) *Size.*—The tumours vary greatly in size in different cases. The smallest are those which occur in the form of annular growths, of localised indurations of the gastric wall, or of superficial ulcerations. Tumours of medium size are met with in disease of the anterior wall, of the curvatures and of the pylorus, and where there is considerable infiltration of the muscular and serous coats of the viscus; while enormous masses are often encountered when the neoplasm has extended into the omentum or has given rise to adhesions between the stomach

and the intestines or the liver. Occasionally a large tumour is formed by the entire stomach, the walls of which have been greatly thickened by diffuse infiltration.

(*c*) *Shape.*—This depends upon the anatomical characters of the growth. Pyloric tumours are oval, rounded, or somewhat tubular; those which affect the anterior wall or the great curvature are often globular; while those which arise from infiltration of the omentum are usually irregular, nodular, or elongated. General infiltration of the gastric walls either gives rise to a mass which retains the normal contour of the stomach, or produces a smooth, hard, elongated swelling, the lower margin of which is more distinct than the upper.

(*d*) *Visibility.*—In addition to the abdominal swelling due to a dilated and hypertrophied stomach, many of the larger growths give rise to tumours which are visible to the naked eye. This is particularly the case when the pylorus is affected and displaced downwards, where the peritoneum is implicated, and where the great curvature is the seat of the disease. Tumours situated at the upper or left extremity of the stomach may only be visible at the end of inspiration or when the viscus is distended with food or gas. A visible tumour was observed in 19 per cent. of our cases.

(*e*) *Situation.*—This varies with the location of the growth in the stomach, the position of the viscus, and the presence of adhesions. In our own cases the tumour occupied the umbilical region in 37 per cent., the epigastrium in 28 per cent., the right hypochondrium in 17 per cent., the left hypochondrium in 16 per cent., and the hypogastrium in 2 per cent. The fact that the majority are found near the umbilicus is due to the downward displacement of the pylorus which accompanies gastric dilatation, and to the great tendency of all growths in this region to extend into the walls of the organ. The epigastrium is the usual site of tumours which arise from disease of the upper border of the stomach, of those formed by implication of the omentum, and of growths which are adherent to the liver. The right hypochondrium is chiefly affected when a pyloric growth is very large, or when it has involved the liver or gall-bladder. A tumour formed by disease of the fundus or of the entire stomach is commonly situated in the left hypochondrium, while the hypogastrium is affected only in those rare instances where a pyloric growth

has been dragged downwards by the weight of the enlarged stomach.

(*f*) *Tenderness.*—This is almost invariably present, though it varies in degree in different cases. It is most marked when the tumour is ulcerated, is of rapid growth, or has infected the peritoneum. As a rule, neoplasms of the central region of the stomach are accompanied by greater tenderness than those of the pylorus, annular strictures of the latter being often painless.

(*g*) *Mobility.*—Tumours of the stomach almost always exhibit a certain degree of mobility, which varies according to their situation and external attachments.

Movement with Respiration.—It is usually taught that a gastric tumour descends upon inspiration only when it is attached to the liver, the spleen, or the diaphragm. Such a statement, however, is totally at variance with fact; for unless adhesions exist which bind the organ to the abdominal wall, the pancreas, or the spine, a downward movement of the tumour with each inspiration can invariably be detected by the hand, if not by the naked eye. As a rule, the excursion is greatest in the female, owing to the displacement of the abdominal viscera which is so often produced by the pressure of corsets. It is also very marked in the subjects of emphysema. The change in the position of the tumour as the result of an inspiratory effort not only indicates its connection with one of the movable abdominal viscera, but also constitutes a valuable aid to its detection, since many growths of the lesser curvature and of the cardiac region of the stomach remain concealed by the ribs unless pushed downwards by a forcible contraction of the diaphragm. Moreover, if by pressure with the hand the tumour can be fixed at the lowest point in its excursion, so that it does not recede towards the chest during expiration, it

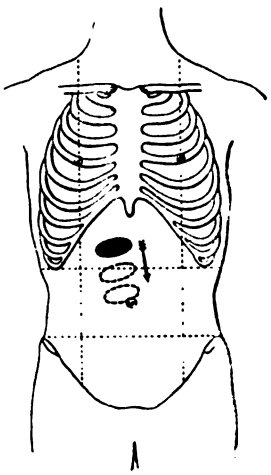


FIG. 40. – Showing the downward movement of the tumour upon inspiration.

is obvious that no adhesions exist between it and the liver or diaphragm. On the contrary, if this is impossible, and the tumour slips upwards despite every attempt to restrain it, the growth will always be found to be attached to some organ in connection with the diaphragm.

Mechanical Mobility.—Many localised tumours of the stomach may be displaced by pressure with the hand. The most mobile are those situated at the pylorus, which may sometimes be moved several inches in every direction; while occasionally growths of the anterior wall, or of the entire viscus, are susceptible of displacement both vertically and

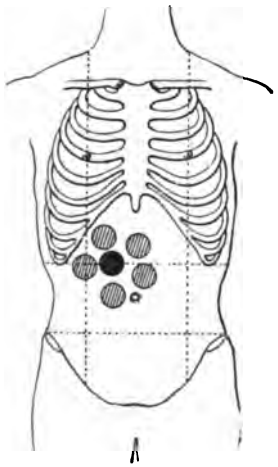


FIG. 41.—Showing the mobility of a pyloric tumour when free from adhesions.

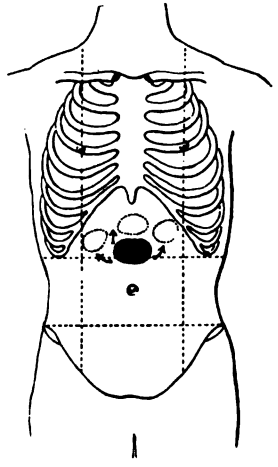


FIG. 42.—Showing the mobility of a growth of the anterior wall when free from adhesions.

laterally. This form of mobility is diminished or entirely prevented by adhesion of the growth to the liver, pancreas, or abdominal wall, or by its fixation in the upper abdomen by its own bulk.

Alterations in the size of the stomach exercise a notable influence upon the position of the tumour. For this reason it is always advisable to record the exact location and apparent size of the growth upon the skin when the viscus is empty, and to repeat the process after the stomach has been distended with water or gas. Under these conditions it may usually be observed: (1) That tumours of the upper margin which were not palpable in the first instance become apparent when the

stomach is inflated; (2) that tumours of the pylorus descend downwards and to the right, those of the great curvature downwards, and those of the fundus downwards and to the left; (3) that growths of the anterior surface become more distinct, and often ascend slightly, owing to the upward rotation of the wall of the organ. Conversely, a patient who exhibits great dilatation of the stomach with an ill-defined tumour in the right hypochondrium when first examined, will often present a comparatively large tumour in the epigastrium, or even in the left hypochondrium, when the organ has been emptied by a tube, owing to the diminution in the bulk of the stomach and the consequent retreat of the pylorus towards the median line.

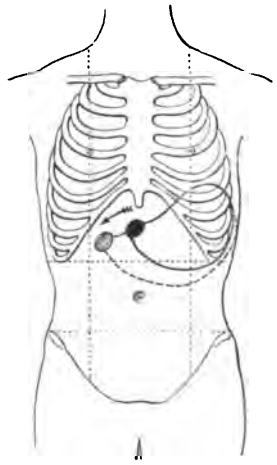


FIG. 43.– Showing the movement of a pyloric tumour upon inflation of the stomach.

The condition of the transverse colon also produces a notable effect upon the location and palpability of a gastric tumour. Thus, many growths appear to descend and to become more distinct after the bowels have been evacuated, while distension of the colon with gas causes them to ascend, and sometimes to become obscured beneath the margin of the ribs.

(*h*) *Pulsation.*—In 17 per cent. of our cases the tumour was stated to have exhibited pulsation. This phenomenon was never observed with growths of the cardia, and was five times as frequent in tumours of the pylorus as in those of the body of the stomach. The movement is invariably derived from the underlying aorta, and is therefore antero-posterior in direction and never eccentric, as in cases of aneurysm. Occasionally the aorta itself is displaced to the right by the mass, or it is so compressed that it becomes dilated above the site of its obstruction (Ott). According to Gabbi, compression of the aorta or of the cœliac axis by a diffuse growth may produce a thrill and a loud systolic bruit. In one of our cases an abdominal aneurysm

coexisted with carcinoma of the pylorus, and led to an erroneous diagnosis.

(*i*) *Percussion.*—When the tumour is situated immediately behind the abdominal wall, light percussion produces a dull note and strong percussion a form of tympanitic dulness. A large intragastric growth attached to the upper margin or the posterior surface is usually comparatively dull when the stomach is empty, but presents a tympanitic note when the viscus is filled with gas. The percussion-note over tumours of the pylorus and of the great curvature is often obscured by a superimposed and adherent colon.

(*k*) *Auscultation.*—Gurgling sounds may often be detected over the pylorus during the efforts of the hypertrophied stomach to force its contents through the contracted orifice, and a similar phenomenon may sometimes be heard at the centre of the viscus in cases of hour-glass stricture. Stenosis of the cardia is associated with retardation or entire suppression of the deglutition sounds. Occasionally pressure of the growth upon the aorta or cœliac axis produces a systolic murmur, which is audible over the epigastrium and back.

(*l*) *Increase of Size.*—All varieties of carcinomatous tumours exhibit an increase of size, which is most rapid in the softer forms of growth.

Changes of shape or the development of a nodular surface usually indicate an extension of the disease to the peritoneum or other neighbouring structures.

Diminution or disappearance of the tumour is occasionally observed when the major portion of the growth has been destroyed by sloughing, or after the establishment of an internal fistula.

Special Features.—(1) *Tumours of the Pylorus.*—These constitute about 60 per cent. of all gastric tumours, and three out of every four (75 per cent.) may be recognised by palpation at one period or other of the disease. Three conditions militate against their detection, viz. localisation of the growth at the orifice, adhesion to the under surface of the liver, and distension of the abdomen by fluid or gas.

In itself a pyloric tumour is seldom of great size, a large nodular mass being usually due to extensive thickening of the omentum, adhesion of the pylorus to the colon, duodenum, or the gall-bladder, or to enlargement of the perigastric glands.

That form of carcinoma which produces the greatest dilatation of the stomach is a contracting scirrhus, and consequently the size of a pyloric tumour is usually inversely proportionate to that of the stomach. On the other hand, a considerable degree of gastrectasis may ensue from an infiltration of the pyloric half of the organ, only a portion of which produces a palpable tumour. These considerations tend to establish three facts: (1) That palpation affords no clue to the real size or extent of the growth, which a necropsy usually proves to be at least twice as large as its physical signs seemed to indicate during life. (2) That extreme dilatation of the stomach is seldom associated with a large tumour, and very often with none at all. (3) That the great bulk of a large tumour is due to implication of the omentum and other viscera in the vicinity of the pylorus.

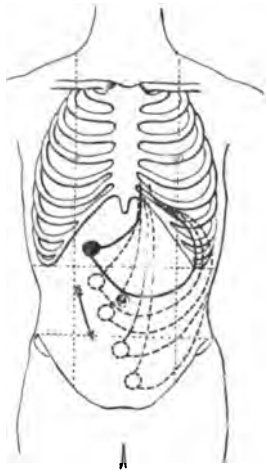


FIG. 44.—Showing the downward displacement of a pyloric tumour free from adhesions by the traction of a dilated stomach.

The shape of a pyloric tumour varies considerably, being round, oval, irregular, or elongated, according as the viscus itself or the surrounding structures constitute the bulk of the mass. In most instances it is situated slightly above and to the right of the umbilicus, and close to the median line of the abdomen; but when the stomach is dilated it is often felt outside the right parasternal line, while if the organ is empty it may be located in the epigastrium or left hypochondrium. In the absence of adhesions the weight of the enlarged stomach gradually displaces the pylorus downwards, so that the tumour may eventually present itself in the hypogastrium, or even in the pelvis.

Mobility is usually a marked feature; the descent upon inspiration being greatest when the growth is adherent to the liver, while if the tumour is not attached to the surrounding viscera it can be moved in various directions by the application of pressure. Tenderness may or may not exist, and when

grasped by the hand the left extremity of the mass may sometimes be felt to alternately harden and relax with each peristaltic movement of the hypertrophied stomach. At such times gurgling may be both heard and felt in the neighbourhood of the tumour, and the mass may pulsate owing to its proximity to the aorta.

(2) *Tumours of the Body of the Stomach (Walls and Curvatures).*—These are usually situated in the epigastric or umbilical region, and are often of considerable size. In shape they are globular, elongated, or irregular, and the surface is frequently nodular from implication of the omentum. In most cases they descend upon inspiration; but lateral mobility seldom exists to any great extent, since it is usually abolished at an early period by the formation of adhesions. Growths of the anterior surface and of the greater curvature are always distinct, and often exhibit a rapid increase of size, while those of the lesser curvature may be detected only on deep inspiration. All varieties afford a dull note on light percussion and a tympanitic sound with a forcible stroke of the finger. Inflation of the stomach obscures a tumour of the upper margin, but renders those of the great curvature more distinct. Distension of the colon displaces them all upwards. A growth of the posterior wall of the stomach seldom forms a palpable tumour.

(3) *Tumours of the Cardia.* Small growths in the immediate vicinity of the cardiac orifice can never be detected by palpation, but should they extend to the lesser curvature or to the fundus of the stomach they may give rise to definite tumours. Carcinoma of the fundus usually produces a mass which is located in the left hypochondrium, and which at first can be felt only on deep inspiration or after inflation of the stomach. At a later period it often projects below the costal margin and extends towards the umbilicus. In most

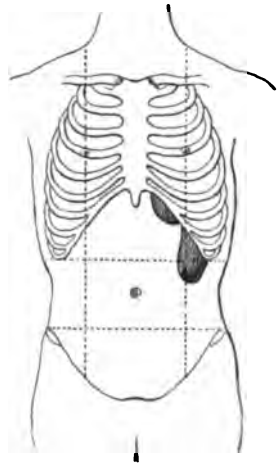
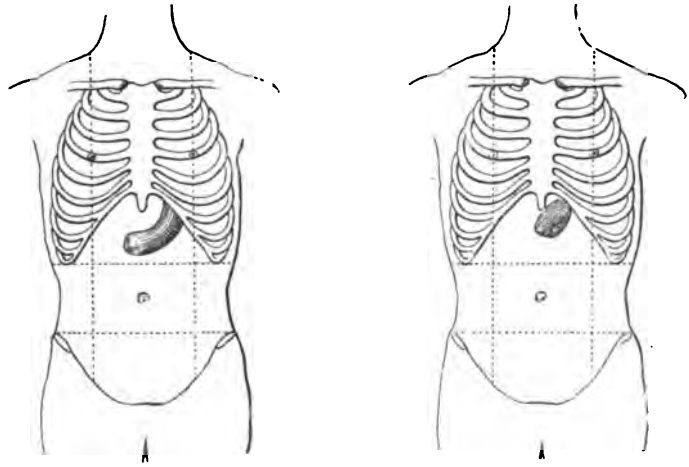


FIG. 45.—Showing the forms of tumour which may be met with in disease of the cardia and fundus.

instances the growth is particularly rapid, great tenderness is present, and the surface of the tumour is nodular, owing to an implication of the omentum. General cancerous peritonitis is apt to follow disease of this region of the organ and to obscure the original growth; while not infrequently the mass becomes fixed to the abdominal wall or to the costal cartilages.

(4) *Tumours composed of the Entire Stomach.*—A palpable tumour may be formed by the entire stomach under two conditions: (*a*) Obstruction of the cardiac orifice with contraction of the empty viscus; (*b*) general infiltration of the gastric walls by the malignant growth.



FIGS. 46, 47.—Showing the forms of tumour sometimes met with in cases of total infiltration of the stomach.

(*a*) It is only in rare cases that obstruction to the entry of food is followed by shrinkage of the stomach to such a degree that it can be felt as a round or somewhat elongated tumour in the left hypochondrium or contiguous portion of the epigastrium. In such cases the mass when grasped by the hand may sometimes be felt to harden and relax alternately. The normal outlines of the stomach cannot be defined, and the region usually occupied by the viscus is filled by the colon.

(*b*) General infiltration of the gastric walls may be accompanied by an oval or elongated tumour which projects from below the left costal margin into the epigastrium, and can often be grasped between the hands. The lower margin is usually

hard and well defined, but the upper is indistinct, especially towards its left extremity. The surface is smooth or somewhat nodular, tender upon pressure, and comparatively dull on percussion. At first the whole mass moves with respiration, and can be displaced from side to side to the extent of an inch or more; but with the progress of the complaint it often becomes fixed by peritoneal adhesions. Unlike other gastric tumours, it does not increase in size unless the omentum becomes infected, but, on the contrary, gradually grows smaller, harder, and more distinct. During the later stages of the complaint it is often obscured by ascites.

Enlargement of Lymphatic Glands.—The fact that glandular tumours occasionally develop above the left clavicle has long been known, but the frequency of their occurrence and their clinical significance have been much exaggerated. Thus, while some writers refer to the presence of palpable glands in that position as pathognomonic of gastric cancer (Friedreich, Henoch), others state that they may be detected in the majority of the cases. To both these statements we are obliged to take exception. In the first place, in most diseases that are accompanied by great emaciation one or more glands may be felt in the left supraclavicular fossa, while not a few examples of malignant disease of the stomach present old tubercular lesions in that position. Again, among a series of cases of gastric cancer which we examined with special reference to this point, nearly 11 per cent. exhibited supraclavicular glands which could be easily felt, but in no instance did microscopic examination after death indicate any malignant infection of the cervical lymphatics. On the other hand, the gradual development of a glandular tumour in the neck, axilla, or groin, which tends to become adherent to the skin and subjacent structures, must always be regarded as an indication of considerable importance. In our hospital series tumours of this character were observed above the left clavicle in 3 per cent., above the right clavicle in 0·5 per cent., in the left axilla in 1 per cent., and in the inguinal region in 2 per cent.

As a rule the glandular enlargement does not appear until a late stage of the disease, and almost invariably indicates extensive infection of the mediastinal or mesenteric lymphatics, but when the gastric symptoms are latent the glandular tumour is occasionally the first sign to attract attention (Lépine).

Enlargement of the glands in the left axilla is usually secondary to involvement of those above the clavicle, while a growth in the right supraclavicular space indicates the existence of metastases in the right pleura or lung. An affection of the inguinal glands is most common on the right side, and often accompanies a diffuse infection of the mesenteric, lumbar, and sacral glands, but it is occasionally associated with metastases in the ovary or other pelvic viscera. In cases of general carcinosis all the superficial glands are apt to become enlarged.

CHAPTER VI

COMPLICATIONS

Perforation of the Stomach

PERFORATION of the stomach occurs in at least 8 per cent. of all cases, but its effects vary under different conditions. If no adhesions exist around the base of the disease, the gastric contents become diffused throughout the abdominal cavity and excite acute general peritonitis; but if the leakage is only slight, or is strictly limited by pre-existing adhesions, the chief result of the accident is the formation of a localised intra-peritoneal abscess.

(1) **General Peritonitis.**—This constitutes the immediate cause of death in about 3 per cent. of all cases of gastric carcinoma, and is most common when perforation occurs on the anterior surface of the organ, near the pylorus. The fact that the accident does not usually ensue until a late period of the disease, when the patient is suffering from profound exhaustion, renders its attendant symptoms less conspicuous than those which usually accompany perforation of the stomach. In those rare instances, however, where an attack of acute general peritonitis is the first indication of the disease, its onset is equally abrupt and its symptoms quite as characteristic as in cases of simple ulcer (Watson, Ellis).

Perforation may occur suddenly and without warning, or it may be preceded for some days by an increase of pain, excessive vomiting, or by profuse hæmatemesis, the two latter symptoms being particularly frequent when the morbid growth has been destroyed by sloughing. In other cases excessive distension of the stomach, violent vomiting, or straining at stool appears to be the immediate cause of the rupture. As a rule, pain in the abdomen is the most conspicuous of the early symptoms; but if great debility exists, or the gastric complaint has been accompanied

throughout by considerable suffering, its significance is liable to escape attention (Given). In debilitated or insane subjects, and also in those where the peritoneum has been implicated by the malignant disease, the abdominal pain is often slight, or even entirely absent. Vomiting is also an inconstant symptom, and when it exists does not materially differ from that which was previously present. The most important indication of perforation is the general appearance of the patient. In every instance, whether pain and vomiting exist or not, a rapid access of weakness may be observed, and within a few hours the face assumes an expression that is highly suggestive of acute peritonitis. The cheeks seem to shrink, the eyes recede into their sockets, the nose becomes pinched, and the skin exhibits a bluish or dusky hue. At the same time the temperature of the body is markedly depressed, the extremities become cold, the pulse is small, quick, and feeble, and the surface of the body is often bedewed with a cold sweat. Examination of the abdomen usually reveals a moderate degree of distension, with some rigidity of the walls and general tenderness; but complete flaccidity of the tissues and an entire absence of pain are quite compatible with suppurative peritonitis. Obscuration of the hepatic dulness from the presence of free gas in the abdominal cavity is rarely to be observed, owing to the frequent existence of adhesions or ascites. Retention of urine is sometimes an important sign, and should diarrhœa have previously existed the sudden onset of constipation seldom fails to attract attention. Life is rarely prolonged for more than forty-eight hours.

(2) **Perigastric Abscess.**—A localised collection of pus as the result of perforation occurs in 3 to 5 per cent. of all cases of carcinoma of the stomach, and is rather more frequent in disease of the cardia than of the pyloric end of the organ.

When the abscess is small in size and deeply situated, it is seldom accompanied by any special symptoms. As a rule, there is some increase of the abdominal pain, which, if previously intermittent, becomes constant and may be associated with frequent retching. The temperature is somewhat elevated, and chills, or even rigors, may occur, while increasing debility and anæmia are invariably present. The physical signs chiefly consist of fulness and tenderness of the epigastrium. Death usually occurs from exhaustion, and the

discovery of an abscess at the necropsy is often quite unexpected.

The larger collections of pus generally form beneath the left wing of the diaphragm, or between the stomach and the abdominal wall. In the former case pain and dyspnœa are prominent symptoms, rigors are not infrequent, and the temperature may be elevated several degrees. The epigastrium and left hypochondrium are distended and tender on palpation; the abdominal walls are rigidly contracted, and no movement of the diaphragm can be detected on deep inspiration. Within a short time the affected side of the chest becomes enlarged, and its lower ribs are thrown outwards, so that the costal angle is increased. The intercostal spaces are also widened, and may bulge to some extent. The displacement of the liver and spleen is often obscured by the tenderness and rigidity of the abdominal wall, but careful percussion will usually show that the left hepatic lobe projects into the epigastrium. In almost every instance the heart is tilted upwards, and its apex may be felt in the fourth intercostal space, rather to the left of its normal position. The base of the left lung is compressed and partially deprived of air, so that the percussion-note over the left posterior base is comparatively dull and the respiratory murmur diminished. This condition is distinguished from pleuritic effusion by an increase of tactile fremitus and vocal resonance over the affected area, and by the occasional existence of moist crepitations. The presence of gas in the abscess-sac beneath the diaphragm gives rise to a tympanitic note over the front of the left chest as far upwards as the fourth rib, which may extend across the sternum to the right nipple-line and downwards to the right costal margin, where it merges with the hyperresonance of the epigastrium. On auscultation over the front and lateral aspects of the left chest the vesicular murmur is found to be either absent or replaced by loud amphoric breathing. The latter phenomenon is usually due to an alteration in the breath-sounds produced by their transmission through the gas-containing cavity; but it is also possible that in some cases a communication between the stomach and the abscess may permit an interchange of gas with each movement of the diaphragm. When the subphrenic abscess contains a large quantity of both pus and gas, metallic tinkling is often audible after coughing, or a loud succussion sound may be produced by move-

ment of the body. Finally, it may be noticed that when two coins are clinked together over the abscess a *bruit d'airain* may be heard over the affected area.

A circumscribed abscess due to perforation of the anterior wall of the stomach is usually situated in the epigastric, left hypochondriac, or umbilical region, where it produces a rounded and tender swelling. Owing to the existence of adhesions the tumour does not move with respiration, nor can it be displaced by manipulation. The percussion-note over it varies according to its contents, being dull when they consist of fluid, but resonant when a large amount of gas is present.

An abscess situated behind the stomach in the lesser cavity of the peritoneum is rarely accompanied by any signs of importance, and in most cases moderate fever of a hectic type, and increasing debility and anæmia, are the only symptoms which indicate the existence of suppuration. If the pus bursts into the stomach, it may appear in the vomit.

The duration of life in cases of perigastric abscess varies according to the stage of the gastric complaint at which it ensues and the intensity of the local inflammation. If the sac is small in size, the fatal event may be postponed for several weeks; but when a large quantity of pus accumulates in the immediate vicinity of the diaphragm, death usually takes place within a week or ten days.

Fistulæ

(1) **Gastro-colic Fistula.**—A fistulous communication between the stomach and the transverse colon occurs in about 2·5 per cent. of all cases of gastric carcinoma, and is most frequent when the primary growth involves the great curvature (*vide* p. 49). This complication only ensues at an advanced stage of the complaint, and its symptoms vary according to the size of the aperture between the two viscera. As a rule, the rupture of the intestinal wall is not accompanied by any noticeable symptoms, but occasionally the patient experiences a sudden and severe pain in the abdomen, which may be accompanied by retching, shivering, or diarrhœa.

Fæcal vomiting is chiefly observed when the fistula is of large size and the pylorus is free from disease, since the establishment of a secondary opening in a stomach which is greatly dilated from pyloric stenosis usually relieves the previous vomit-

ing, by permitting the contents of the viscus to escape into the bowel. On the other hand, a small or valvular opening in the colon may only be accompanied by a fæcal odour in the ejecta or an intensely foul taste in the mouth. The *passage of undigested food* immediately after it has been swallowed (lienteric diarrhœa) is another important indication of a gastro-colic fistula, and usually replaces the periodic vomiting from which the patient previously suffered. In every case the intestinal complication is accompanied by a rapid increase of the debility and cachexia, and death usually ensues within a fortnight of its development.

Diagnosis.—A gastro-colic fistula is seldom difficult to recognise when accompanied by fæcal vomiting or lienteric diarrhœa, but when it merely produces an unpleasant odour in the breath or the vomit it is liable to be overlooked. Reeves was the first to notice that enemata are often vomited if much force has been employed in their administration; and this fact is of considerable value in diagnosis, since the rejection of a coloured fluid soon after it has been injected into the bowel necessarily indicates the existence of an abnormal communication between the colon and the stomach. In one case v. Ziemssen was able to detect the fistula by observing that when gas was introduced into the rectum it escaped into the stomach without distending the colon. According to Levinstein, loud gurgling sounds may be heard over the site of the fistula upon auscultation of the abdomen. The formation of a fistula between the stomach and the *small intestine* can only be surmised by the sudden subsidence of vomiting and other symptoms of dilatation of the stomach, and their replacement by diarrhœa.

(2) **Gastro-cutaneous Fistula.**—This condition is much less frequent as the result of cancer than of simple ulcer of the stomach, and occurs in only 0·26 per cent. of the cases of the former disease (*vide* p. 51). It is interesting to observe that out of the nineteen cases which have been recorded, fourteen occurred in women and only five in men, the average age in the former sex being forty-two and in the latter fifty-six years. In every instance the formation of the fistula was preceded for some time by a palpable tumour, which usually occupied the umbilical region, but occasionally presented itself in the left or even in the right hypochondrium. Pain was invariably present,

and the temperature of the body was often elevated. In those cases which were not subjected to surgical treatment adhesion of the growth to the abdominal wall was followed by redness and œdema of the skin, subcutaneous emphysema, and finally by the discharge of a small quantity of turbid fluid through one or more openings at the summit of the tumour. The discharge consisted of pus, serum, or of a greyish fetid material, which, after an interval that varied from eleven days (Petit) to a month (Auger), became mixed with particles of food. The introduction of a probe revealed a cavity of some size behind the abdominal wall, but no direct communication with the stomach could be discovered. Death ensued from debility, aggravated by the discharge, and occurred at varying intervals after the formation of the fistula, viz. three days (Féréol), twenty-one days (Wencker, Stokes), twenty-three days (Leflaive), one month (Cameron, Balluff, Murchison, Monod), six weeks (Coote), seven weeks (Feulard), and three months (Petit, Auger.)

As a rule the intra-peritoneal abscess which preceded the formation of the fistula was easily recognised, but in four instances where the patient was less than thirty-five years of age it was mistaken for tubercular peritonitis. In several cases also the connection of the abscess with the stomach was not surmised until after the discovery of particles of food in the discharge.

Metastases

Secondary growths occur so frequently, and exert such an important influence upon the symptoms and signs of the gastric complaint, that it is necessary briefly to consider the clinical phenomena that attend their development in the principal organs of the body.

(1) **Metastases in the Liver.**—Secondary deposits are met with in the liver in at least 35 per cent. of all cases. In some instances only one or two nodules are discovered after death, while in others the entire organ appears to be replaced by aggregated masses of carcinoma. As a rule the size of the individual metastases is inversely proportionate to their number, and it is often observed that the hepatic affection is most marked when the primary growth in the stomach is comparatively insignificant. This latter fact helps to explain the infrequency of gastric symptoms in cases where the liver is extensively

involved at an early period. The situation of the growths varies according to their mode of formation, those produced by infection of the portal system usually developing in the substance of the organ, while those that arise from infection of the lymphatics are often situated beneath the capsule. The right lobe of the liver is principally affected when the pyloric and central regions of the stomach are the seat of disease, and the left lobe in cases of primary carcinoma of the cardia. The most rapid and extensive destruction of the hepatic tissue is associated with soft ulcerated growths of the upper margin of the stomach, while a localised scirrhus of the pylorus which produces great dilatation of the stomach is the least malignant in this respect. The period at which the liver becomes affected varies greatly in different cases; in some instances large tumours appear within three months of the onset of the gastric symptoms, while in others enlargement of the organ is detected only during the last few weeks of life. The rapid infection of the liver which so often occurs during the warm months of the year may be partly responsible for the higher death-rate from carcinoma of the stomach that obtains between May and September.

It is always difficult to differentiate between the symptoms which arise from secondary disease of the liver and those that attend the primary complaint and coexisting metastases in other organs. As a rule, however, secondary growths of the liver are accompanied by severe and constant pain in the right hypochondrium and back, which is increased by exertion and is often worse at night. In every case, also, the emaciation, cachexia, and anorexia become greatly increased when the liver is infected, while in many instances the pain after food and vomiting which previously existed tend to diminish. Contrary to the usual statements on the subject, jaundice is a comparatively rare result of the hepatic affection, only about one-fifth of the cases of icterus being directly referable to it. Ascites occurs in about 21 per cent. of the cases where the liver is affected, and in about 50 per cent. of those where there is coexisting disease of the peritoneum. In most instances it is only moderate in amount, and does not appear until the liver is already much enlarged. An excess of urobilin in the urine is supposed to accompany the destruction of the liver substance by the new growth (Tissier).

The physical signs vary according to the number and position of the secondary growths. When these are few, and situated deeply in the substance of the right lobe, the liver appears to be enlarged and presents a smooth surface and a well-defined edge, while posteriorly the area of hepatic dulness is found to be much increased. If, on the other hand, the metastases project upon the surface, they may usually be felt in the form of rounded tumours, which increase in size and are often very tender upon pressure. Scirrhous deposits are sometimes distinctly concave or 'cupped,' owing to the contraction of their fibrous substance. Carcinoma of the cardia is often associated with enlargement of the left lobe of the liver, or with a nodular growth in that portion of the organ situated in the epigastrium. A solitary tumour in the region of the gall-bladder usually indicates a direct extension of carcinoma into the liver from an adherent pylorus. Among the minor indications of the disease are œdema of the legs, enlargement of the superficial veins of the abdomen, and slight albuminuria.

(2) **Metastases in the Peritoneum.**—These exist in about 35 per cent. of all cases of carcinoma of the stomach, and occur most frequently when the greater part of the organ or its upper margin is affected by the disease. Secondary growths are chiefly met with in the great omentum, which becomes converted into a hard, nodular, sausage-shaped mass adherent to the anterior aspect of the stomach or colon. Less frequently the general surface of the peritoneum presents numerous discrete tumours, which vary in size from a pea to a Tangerine orange, and are especially abundant in the pelvis and in the mesentery. Finally, in rare cases the serous membrane exhibits a diffuse miliary carcinosis, which closely resembles tubercle in appearance and frequently extends through the lymphatics of the diaphragm to the pleuræ or the pericardium. It is therefore obvious that, while secondary carcinoma of the peritoneum may present certain features which are common to each variety, the physical signs of the disease vary according to the size, situation, and number of the metastases.

Pain is an inconstant feature of the complaint, and when present it is distinguished with difficulty from that which accompanies the primary growth. It is usually most conspicuous before the development of ascites, and is especially severe in cases of miliary carcinosis, where its onset may be so sudden as

to simulate acute general peritonitis. *Flatulence* and *constipation* are always marked symptoms, and the distension that ensues after meals is a constant source of complaint. An invasion of the general peritoneum is always accompanied by a rapid failure of strength, and life is seldom prolonged for more than three months. The chief signs of the disease consist of ascites and the presence of one or more palpable tumours in the abdomen.

Ascites often develops quite suddenly, but it is rarely excessive, and is apt to vary in amount from time to time. A sudden increase of weight which is sometimes observed during the course of the gastric complaint is usually due to peritoneal effusion. As a rule the fluid is easily detected by palpation and percussion, but when extensive adhesions exist between the intestines and the abdominal parietes it is apt to become encysted, and may then be mistaken for a tumour. In cases of miliary carcinoma the mesentery becomes gradually contracted, with the result that the intestines are drawn backwards to the spine and are completely concealed by the serous exudation. Under these circumstances the anterior aspect of the abdomen is dull on percussion, while a large tympanitic area exists posteriorly over the back and loins.

The fluid removed by tapping is usually of a clear amber colour, and according to Runeberg contains a much larger percentage of albumin (4–6 per cent.) than that of dropsical effusions (1½–2½ per cent.). Microscopic examination of the sediment sometimes reveals clumps of cancer cells, or isolated cells which show atypical mitoses. Colloid changes in the cells may be detected. When the peritoneal growths are numerous and very soft the fluid is often hæmorrhagic, while in cases where there is obstruction of the thoracic duct or lacteals a chylous exudation is sometimes observed (Weiss). Paracentesis may be followed by the development of a cancerous nodule at the site of the puncture. The peritoneal tumours may be limited to the vicinity of the stomach or disseminated throughout the abdomen. The former condition, which is by far the more common, was observed in 22 per cent. of our cases, and the morbid growths were usually found after death to occupy the great omentum or the gastro-splenic or gastro-hepatic omentum. In such cases one or more tumours are detected in the epigastrium, left hypochondrium, or umbilical region, which present a somewhat indefinite outline, a hard

nodular surface, and a dull note on light percussion. At an early stage they move freely with respiration, but at a later period they are apt to become fixed by adhesions. Manipulation gives rise to pain, and periodic examinations reveal a progressive increase of size. In most instances the umbilicus becomes retracted and fixed, and not infrequently a cordlike induration of the linea alba may be felt. Diffuse growths of the peritoneum were detected during life in only 2 per cent. of our cases of gastric carcinoma, and were always associated with ascites. They chiefly occur in the region of the umbilicus or near the cæcum, where they give rise to hard, rounded, tender, and slightly movable tumours; but sometimes the whole abdomen appears to be filled with masses of various sizes. It is in this condition that exploration of the pelvis is of such importance, since one or more growths may often be detected in the pouch of Douglas or between the bladder and the rectum long before a palpable tumour develops in the abdomen. Miliary carcinoma never gives rise to palpable tumours. Thrombosis of the femoral and saphenous veins, œdema of the legs, secondary nodules in the skin of the abdomen, and purpuric eruptions are liable to ensue during the course of the peritoneal disease.

(3) **Metastases in the Lungs.**—These occur in about 8 per cent. of all cases, and are chiefly met with in the lower lobes. In most instances they develop at a late stage of the disease, and are usually, though not always, associated with multiple growths of the liver. The special symptoms which are supposed to ensue from the pulmonary affection are pain in the chest, dyspnœa, cough, expectoration, and hæmoptysis (Darolles), while examination of the chest reveals dulness on percussion, bronchial breathing, and crepitation. As a matter of fact, however, the pulmonary condition is so often associated with a pleural effusion that its existence is usually merely a matter of surmise.

Carcinoma of the Pleura is frequently associated with disease of the peritoneum, and is also apt to occur from infection of the mediastinal glands or the lung. Pleurisy on the left side is often observed along with growths of the cardia, especially when the disease has extended into the œsophagus, and in such cases a hæmorrhagic effusion is sometimes encountered. Perforation of the œsophagus may be followed by pyopneumothorax or gangrene of the lung. Blood-stained fluid in

the right pleura is usually associated with disease of the liver or of the lung.

(4) **Metastases in Lymphatic Glands.**—An invasion of the gastric lymphatic glands occurs in every case, but it is comparatively rare for their enlargement to produce any special symptoms. Occasionally, however, the great bulk of a pyloric tumour is found to consist of cancerous glands, and in rare instances an early infection of those in the portal fissure gives rise to jaundice or ascites. Disease of the cœliac glands may produce partial obstruction of the aorta or vena cava, and occasionally gives rise to a palpable tumour.

Disease of the posterior mediastinal glands is rarely accompanied by special symptoms, but occasionally attacks of spasmodic dyspnœa, palpitation, or tachycardia ensue from compression of the vagi or sympathetic nerves (Mathieu). Metastases situated between the œsophagus and trachea, below the thyroid, are responsible for the paralysis of the left recurrent laryngeal nerve which is sometimes observed (Bristowe). Enlargement of the superficial glands has already been discussed (p. 175).

(5) **Metastases in the Intestine.**—In the majority of cases the occurrence of intestinal obstruction is due to direct extension of the disease to the transverse colon; but in three instances which have come under our notice the condition was dependent upon malignant stricture of the ileo-cæcal valve, of the descending colon, or the rectum. In every instance the intestinal symptoms completely masked those arising from the primary complaint, which in two out of the three cases was not recognised during life. It is possible that in many instances of this description the intestinal lesion is really a primary growth, and not a mere secondary deposit (*vide* p. 24).

Jaundice

This occurs in about 13·7 per cent. of all cases, and is most common when the body of the stomach is affected or the pylorus infiltrated without the production of a stricture.

In four-fifths of the cases the icterus arises from secondary disease in the head of the pancreas, or from pressure upon the hepatic or common bile-duct owing to an extension of the growth behind the stomach. Metastases in the liver, portal throm-

bosis, and septicæmia are chiefly responsible for the remaining cases.

As a rule the icterus develops slowly, and the skin gradually acquires the greenish or black tinge indicative of a complete and permanent block of the bile duct. Occasionally, however, its onset is quite abrupt, and in rare instances it is the first symptom to attract attention (Michel). Temporary improvement sometimes ensues from the use of saline purgatives, or the colour of the skin and the urine varies in intensity from week to week. The liver is invariably enlarged, and somewhat tender upon pressure, and if ascites is present the fluid is usually bile-stained. The complication tends to shorten life by producing further impairment of the appetite and by increasing the rapidity of the emaciation. Occasionally death ensues rapidly from a form of coma like that met with in acute yellow atrophy of the liver.

Thrombosis

Venous Thrombosis is met with in about 4·5 per cent. of all cases of carcinoma of the stomach, and almost invariably occurs at a late period of the complaint, when the patient is confined to bed. It is most frequent when the gastric symptoms are comparatively latent and when the disease is accompanied by leuchæmia.

As a rule, the femoral, saphenous, or external iliac veins are chiefly affected, especially those of the left side; but sometimes the thrombotic mischief extends upwards from one vessel to another, or after a short interval the corresponding vessel of the opposite limb becomes occluded. Less frequently the subclavian, axillary, basilic, or external jugulars are involved, while in rare instances thrombi form in most of the superficial veins of the body (Osler and McCrae). Among those situated internally the inferior vena cava, the vena portæ, the pulmonary, mesenteric, and renal veins are most often affected.

Thrombosis of a vein in a limb is usually accompanied by pain, and followed by œdema of the tissues and a blue colouration of the skin; but if the patient is extremely asthenic the process may be quite painless and the swelling only discovered by accident. Occlusion of the internal iliac vessels is sometimes associated with hæmorrhage from the rectum.

Portal thrombosis gives rise to the rapid development of

ascites, or, if free fluid already exists in the peritoneal cavity, its quantity is suddenly and greatly augmented. Occasionally it is found to be hæmorrhagic, and the patient may pass bright blood with his evacuations. Œdema of the legs ensues from pressure of the fluid upon the inferior vena cava. *Suppurative pylephlebitis* is very rare, and in the case recorded by Wickham Legg it was accompanied by ascites, œdema of the legs, and difficulty of micturition. Renal thrombosis is indicated by hæmaturia, pain in the loin, and by a diminution in the amount of urine. Pulmonary embolism may ensue from the detachment of a clot from a peripheral vein or from the right side of the heart.

Arterial Thrombosis is comparatively rare and chiefly occurs in the femoral, popliteal, and cerebral vessels. Whipham has recorded a case in which thrombosis of the left femoral and popliteal arteries was followed by gangrene of the leg, and a similar condition of the liver and transverse colon has been observed from occlusion of the hepatic and colic arteries respectively (Cooper, Denonvilliers, Goullioud, and Mollard). In a case of pyloric cancer published by Flint the patient was suddenly attacked by blindness and paralysis of the right arm owing to thrombosis of the left middle cerebral, and in a similar one by Merklen there were right hemiplegia, aphasia, and loss of sensation on the affected side.

Venous thrombosis is probably due to the altered state of the blood and the great enfeeblement of the heart that accompany the later stages of carcinoma of the stomach. The greater liability of the veins of the left leg may be due to the pressure exerted upon the external iliac vein by an overloaded sigmoid flexure. Thrombosis of both femorals and iliacs usually indicates pressure upon the inferior vena cava. Trousseau was accustomed to regard thrombosis of a vein in the arm or leg in a case of gastric disease as pathognomonic of carcinoma, but its diagnostic value is less than was formerly believed. From the point of view of prognosis the occurrence of thrombosis may be held to indicate the near approach of the end, and the occlusion of a cerebral vessel as its immediate precursor.

Secondary Inflammations

Certain organs of the body are liable to become affected with chronic inflammation independently of the formation of secondary deposits in their substance.

Chronic Gastritis, both parenchymatous and interstitial, invariably accompanies carcinoma of the stomach, and is especially severe when the growth has given rise to obstruction of the pylorus. In these cases most of the early symptoms are due to the inflammatory state of the viscus.

Chronic Enteritis is encountered in a large proportion of the cases, though it seldom gives rise to any special symptoms. Occasionally, however, pain and diarrhœa occur towards the termination of the complaint, and after death a few superficial ulcers are found in the colon, or the intestinal mucous membrane presents signs of diphtheritic inflammation. These conditions are probably due to the long-continued retention and decomposition of the fæces.

Chronic Nephritis.—In 15 per cent. of our cases the kidneys presented a granular surface, with adhesion of the capsule and other signs of interstitial inflammation, but albuminuria existed in only about one-fifth of them. Occasionally subacute parenchymatous nephritis develops during the course of the gastric complaint, accompanied by general œdema, anæmia, and albuminuria, and terminates fatally by pericarditis or uræmic coma. Uræmic convulsions are often mistaken for evidence of metastases in the brain.

Pneumonia is the immediate cause of death in about 6 per cent. of all cases of gastric cancer. It chiefly occurs during the last stage of the complaint, and usually exhibits a lobular distribution. As a rule its onset is accompanied by a sudden rise of temperature, dyspnœa, and cough, but pain is seldom a subject of complaint and hæmoptysis is rarely observed. In many instances delirium is the only symptom. The temperature is very irregular and seldom rises above 103° F. (fig. 34, p. 138), while the signs of pulmonary consolidation often remain latent. Death usually occurs within three days.

Nervous Diseases

(1) **Mental Derangements.**—The depression that invariably accompanies the disease is very liable to pass into melancholia,

which may be attended by suicidal tendencies. Less frequently delusional insanity develops during the course of the gastric complaint, or symptoms of acute mania suddenly manifest themselves. Among the 160 cases recorded by Dittrich, five were insane and two suffered from violent mania.

(2) **Cerebral and Spinal Paralyses** are met with in about 1·5 per cent. of all cases, and are principally due to metastases in the brain or spinal cord, thrombosis of vessels, or to direct invasion of the vertebral column by the morbid growth. Examples of the latter kind have been recorded by Brun, Lagrange, and others, in which destruction of the dorsal or lumbar vertebræ was attended by an intense girdle pain and by partial or complete paraplegia.

(3) **Peripheral Neuritis.**—In 1886 Oppenheim and Siemerling drew attention to the occasional development of peripheral neuritis in carcinoma accompanied by profound cachexia; and Klippel found degeneration of the nerves of the lower extremities in two cases of cancer of the stomach. More recently Auché and Miura have described typical examples of the nervous affection which appeared to have resulted from absorption of toxic substances from the diseased stomach.

(4) **Tetany.**—It was formerly believed that tetany was solely encountered in cases of pyloric obstruction due to the cicatrisation of a simple ulcer, but Trevelyan has recorded an instance in which it attended a carcinomatous stricture of the duodenum, which had given rise to dilatation of the stomach.[1]

The principal feature of this interesting complaint is the occurrence of a tonic spasm affecting the voluntary muscles of the body. Its onset is usually quite sudden, and often follows an attack of vomiting or diarrhœa. In typical cases the elbows and wrists are partially flexed, the forearms strongly pronated, the fingers adducted and firmly bent over the thumbs, while the palms are hollowed by the approximation of the thenar and hypothenar eminences. In the lower limbs, the legs are rigidly extended, the soles of the feet turned inwards, and the heels drawn up. Considerable pain is often experienced during the continuance of the spasm and the affected parts are sometimes cold and blue. The condition of the superficial reflexes is variable; but the deep reflexes are much exaggerated, and the muscles react more readily than usual to the inter-

[1] See Author's *Ulcer of the Stomach and Duodenum*, p. 311.

rupted current. Sometimes an attack may be induced by percussion of the epigastrium, by the administration of an enema, or by compression of the main artery of a limb.

The other phenomena associated with this condition are neither uniform nor of great importance. The pupils are often contracted during the attack, but they still react both to light and accommodation. Severe headache is a frequent cause of complaint, and occasionally profuse perspirations are observed. Retention of urine occurs in the majority of the cases, and when the fluid is drawn off by a catheter it is often found to contain a trace of albumin. Sugar and acetone are occasionally detected in it. Cutaneous sensibility rarely undergoes any noticeable alteration, but in a few instances temporary hyperæsthesia or anæsthesia has been observed. The pulse is full and regular, the breathing quick and shallow, and the face and extremities usually show signs of cyanosis. The temperature is often depressed at first, but in fatal cases it usually rises, and may reach 109° F. before death. The intellect generally remains unaffected.

In almost every instance the first attack is followed within a short time by several others, but occasionally the initial seizure is separated from the second by an interval of several weeks. The actual duration of the spasm is also liable to considerable variation; in some instances it lasts from five minutes to several hours, while in others it remains almost constant for three or four days.

Occasionally the condition of simple tetany is complicated by the occurrence of general convulsions, which affect the muscles of the neck, jaw, back, and face. The attacks are intermittent and last from a few minutes to half an hour, disappearing as suddenly as they commenced, and leaving the muscles in a state of semi-rigidity. During their continuance the patient is unable to open his mouth or to swallow, and sometimes suffers from opisthotonos. This form of convulsions must therefore be regarded as a species of tetanus. Finally, in a small proportion of the cases the initial tetany is followed by convulsions that are indistinguishable from epilepsy. Gastric tetany is a very dangerous complaint, and is probably always fatal when it attacks the subjects of carcinoma. It appears to be due to the absorption into the general circulation of some toxic substance generated in the dilated stomach.

Purpura

A purpuric eruption sometimes accompanies venous thrombosis, septicæmia, or gradual failure of the heart. Thibierge has also described a hæmorrhagic eruption which affects the anterior surface of both lower extremities in a symmetrical manner. This condition, to which he gives the name of 'cachectic purpura,' is very rare, and is followed by death within a few days. The hæmorrhages from the intestine and the kidney which are often termed 'purpuric' are usually due to thrombosis of the iliac or renal veins.

Septicæmia

This is a very rare complication, and is almost always associated with extensive ulceration of the primary growth or with an abscess in the peritoneum or one of the neighbouring organs. In the majority of cases it is characterised by an elevated irregular temperature, rapid emaciation, and intense anæmia; but occasionally abscesses form in the subcutaneous tissue, pus collects in the larger joints, or jaundice develops. In 2·3 per cent. of our cases ulcerative endocarditis of the aortic or mitral valves was discovered after death. In the case recorded by Hanot both the blood and the contents of the stomach contained streptococci.

CHAPTER VII

CLINICAL VARIETIES

THE protean features of carcinoma of the stomach afford a great temptation to differentiate a large number of clinical varieties, according to the predominance of some particular group of symptoms or physical signs; and however much one may deprecate the growing tendency to found clinical distinctions on slight differences of symptomatology, it is impossible to offer an adequate description of the disease without special allusion to certain cases that are attended by exceptional difficulties of diagnosis. Thus, the general aspect of the complaint varies to such a great extent according to the location of the neoplasm, that it is necessary to consider in detail the various symptoms that arise from obstruction of one or other orifice, from invasion of the walls or curvatures, and from a general infiltration of the stomach. Again, it frequently happens that the cardinal symptoms of the malady are either suppressed or completely masked by those which ensue from the early invasion of another viscus, and it is therefore convenient to distinguish a latent form of the affection from those which are characterised by dyspepsia, extreme anæmia, ascites, or symptoms of septicæmia. Finally, the precocious development of gastric carcinoma deserves attention on account of its rarity, and also the form which is engrafted upon a simple ulcer.

(1) **Carcinoma of the Cardia.**—The cardiac third of the stomach is primarily affected in about 10 per cent. of all cases, and is more frequently involved in men than in women. As a rule the previous health has been extremely good, but occasionally the onset of the disease is preceded for some months by pyrosis. The first symptom to attract attention is usually a difficulty of swallowing, which is often attributed to soreness of the throat or to the ingestion of a fish-bone or other foreign body; but occasionally it develops quite suddenly and without apparent cause. Each

mouthful of solid food appears to stick in the gullet, and deglutition is accompanied by a sense of uneasiness, fulness, or of actual pain behind the lower end of the sternum. At the same time there is usually a complaint of want of appetite, loss of flesh, breathlessness on exertion, and debility, and sometimes of attacks of sharp pain in the left side of the chest and back. Gradually the dysphagia increases, until every attempt to swallow solids is accompanied by choking and regurgitation of the food, and

FIG. 48.—Soft ulcerating growth of spheroidal-celled carcinoma situated at the cardiac orifice and spreading into the œsophagus. (London Hospital Museum.)

even liquids are rejected unless taken slowly and in small quantity. These phenomena occupy from three to seven months in their development, at the end of which period the patient presents a pallid, careworn, and starved appearance, and is found to have lost between two and three stones in weight. The symptoms of the final stage vary in different cases. Severe hæmorrhage is rare, but not infrequently the ejecta consist of grumous material or exhibit streaks or clots of bright blood.

In most instances increasing debility compels the patient to keep his bed, and he gradually succumbs to asthenia. In other cases delirium supervenes, the mouth and throat are attacked by thrush, and death ensues from exhaustion, secondary pneumonia, or from septic absorption from the dilated œsophagus. Perforation of the stomach is rare, but sometimes sloughing of the œsophagus gives rise to empyema, pneumothorax, or gangrene of the left lung. Occasionally ulceration of the growth removes the obstruction, so that food can once more be swallowed with comparative ease. Death usually occurs within nine months.

When the disease affects the cardiac region or the fundus, without involvement of the œsophagus, dysphagia is absent and the principal symptoms are those of dyspepsia. Pain is almost always present, and is chiefly experienced immediately after a meal containing solid food, but it may also be provoked by hot liquids, or even by milk. Vomiting occurs in the majority of cases, but affords little relief to the pain. Slight hæmatemesis is also a frequent symptom, but owing to the integrity of the pylorus the blood is more often bright-red than altered by its retention in the stomach. Anorexia, loss of flesh, and cachexia are prominent symptoms, and diarrhœa often alternates with or replaces the usual constipation. Life is rarely prolonged more than a year, and death usually occurs from exhaustion, aggravated by secondary disease of the liver or peritoneum.

Stenosis of the cardiac orifice may be recognised by the resistance offered to the passage of a soft tube at a spot about 16–18 inches (40–47 cms.) from the incisor teeth, and by the evacuation in the eye of the instrument of a small quantity of undigested food which had accumulated above the stricture. Examination of the latter shows it to consist of alkaline mucus and saliva, mixed with milk and particles of food, and occasionally with pus or blood; while the microscope reveals the existence of salivary corpuscles, blood-cells, and sometimes of small portions of the neoplasm detached by ulceration. Auscultation over the epigastrium demonstrates a considerable delay, or even suppression, of the second deglutition sound, which under normal circumstances may be heard in seven to twelve seconds after the patient has swallowed a mouthful of fluid. The disease is rarely accompanied by a palpable tumour, though occasionally the contracted stomach forms an elongated

or rounded swelling, which can be felt between the ensiform cartilage and the left costal margin.

Carcinoma of the fundus is usually associated with a nodular tumour, which occupies the left epigastrium or hypochondrium, descends upon inspiration, and is susceptible of slight lateral displacement. The stomach itself is often smaller than normal, and in 68 per cent. of the cases its contents after a test meal are

FIG. 49.—An enormous ulcerated fungoid growth of cylinder-celled carcinoma involving the greater part of the stomach and extending into the œsophagus. (Museum of the London Temperance Hospital.)

found to be free from hydrochloric acid and to exhibit an excess of lactic acid. At a late stage the omentum and the left lobe of the liver often present metastases, and the glands above the left clavicle may become enlarged. When the disease gives rise to a stricture near the centre of the organ, the symptoms resemble those of pyloric stenosis, and examination shows considerable dilatation of the fundus without a palpable tumour.

Sizzling and gurgling sounds may sometimes be heard over the epigastrium.

(2) **Carcinoma of the Body (Walls and Curvatures).**—Growths which affect the central region of the stomach are usually extensive, of soft consistence, and of rapid growth, and are consequently accompanied by numerous symptoms and important physical signs. Pain is experienced in the majority of the cases, and is usually increased by food, while sloughing of the growth or implication of the peritoneum often gives rise to acute and continuous suffering. Vomiting is an inconstant

FIG. 50.—Stomach viewed from behind, showing enormous infiltration of its walls with soft spheroidal-celled carcinoma, and its cavity almost obliterated by a cauliflower growth. (London Hospital Museum.)

phenomenon, and chiefly occurs during the periods of digestion or in the early morning. Nausea and retching are common sources of complaint, and anorexia, loss of flesh, and cachexia are invariably present. Hæmatemesis is frequent but variable in quantity, a coffee-ground appearance of the vomit indicating oozing from the surface of the neoplasm, while the ejection of bright blood is usually associated with ulceration of the growth. Fatal hæmorrhage may ensue from the destruction of a large artery, and general or local peritonitis from perforation of the coats of the stomach. When metastases develop in the liver or peritoneum at an early period, the symptoms due to the

primary disease often diminish or even subside. In many cases there is an elevation of temperature. Death usually takes place from exhaustion within twelve months, and in only about 13 per cent. is life prolonged for more than a year.

A palpable tumour exists in about 81 per cent. of the cases, and usually occupies the epigastric, umbilical, or left hypochondriac region. It presents a nodular surface, an indefinite outline, a dull note on light percussion, and is movable by palpation and with respiration. Examination shows that the stomach is moderately dilated, and that its contents are free from hydrochloric acid. Small particles of the neoplasm or cells showing atypical mitoses may be extracted by a tube, and the Oppler-Boas bacillus often accompanies the signs of lactic acid fermentation. Thrombosis of the veins of the lower extremities and metastases in the abdominal wall are not infrequent.

(3) **Carcinoma of the Pylorus.**—Disease of this part of the stomach constitutes about 60 per cent. of all the cases. The initial symptoms are usually those of indigestion, and for several months the chief complaint may be flatulence and distension after meals, acidity, constipation, loss of appetite, and emaciation. In every instance vomiting occurs sooner or later, and although at first it may only be occasional, and afford temporary relief to the other symptoms, it gradually increases in frequency until it is repeated once or twice each day. The ejecta are considerable in quantity, and consist of a sour-smelling fluid, in which undigested articles of food may be recognised which were eaten some days previously. From time to time an extreme degree of gastric intolerance is apt to develop from intercurrent gastritis, accompanied by incessant retching and vomiting of mucus. Pain is rarely severe until the growth has undergone ulceration, when great suffering may be experienced, either continuously or within half an hour after food. Anorexia is usually pronounced, the tongue is foul, the bowels are confined, and the pulse is of low tension. Profuse hæmatemesis is comparatively rare, but both the vomit and the contents of the stomach extracted by a tube frequently contain small quantities of altered blood. The duration of life varies in different cases, fatal exhaustion usually ensuing within nine months when the pyloric obstruction is severe, while life may be prolonged for more than twice that period if the orifice is only slightly affected. Extension of the growth along the great curvature may produce obstruction of the colon or a fistula.

The chief sign of the disease consists of dilatation and hypertrophy of the stomach, which may be recognised by visible peristalsis, by stagnation of the food, and by a notable enlargement of the viscus on artificial inflation. Free hydrochloric acid disappears at an early period in the vast majority of the cases, and is replaced by an excess of lactic and other organic acids. The Oppler-Boas bacillus, torulæ, sarcinæ, and other micro-organisms may be recognised in the gastric contents, and the sulphocyanide of potassium in the saliva is greatly reduced in quantity. In about 71 per cent. of the cases a tumour may be detected in the epigastric, umbilical, or right

FIG. 51.—Scirrhous carcinoma of the pylorus causing stenosis. (London Hospital Museum.)

hypochondriac region, which is of an oval or round shape, movable with respiration, and often capable of being displaced by the hand. Distension of the stomach displaces the tumour to the right, and when the organ is greatly dilated and the growth non-adherent to the liver the traction of the heavy viscus may drag the tumour into the lower part of the abdomen. Secondary deposits in the liver or peritoneum rarely coexist with severe stenosis of the pylorus.

(4) Total Infiltration of the Stomach.—This condition is very rare, and is met with in less than 3 per cent. of all cases. When the morbid growth is fibrous in character the stomach

becomes greatly reduced in size and presents the appearance of a leather bottle; but the soft spheroidal- and cylindrical-celled carcinomata produce a greater thickening of the gastric wall with a lesser diminution of lumen. In the former case the disease may run a protracted course, and is often unaccompanied by metastases, while in the latter death occurs at an earlier period, and is usually accelerated by secondary growths of the peritoneum or liver.

For several months the chief symptoms consist of discomfort, flatulence, and distension after meals, with anorexia, loss or flesh, debility, anæmia, and constipation. As soon as the greater part of the stomach has been involved, or one of the orifices is contracted, vomiting becomes the most prominent feature, and increases in severity until the end. At first it chiefly ensues after the ingestion of an unusually large meal, when the patient feels that he has overtaxed the capacity of his stomach and rejects the surplus amount as an infant does under similar circumstances. Gradually the quantity of food has to be reduced, until less than six fluid ounces can be swallowed without producing regurgitation. About this period attacks of acute gastritis are apt to supervene, and to give rise to continuous retching and vomiting, which prevent the administration of food by the mouth. When these acute symptoms subside the general health is found to have greatly deteriorated and the power of absorption to be much impaired. The final stage of the disease is characterised by the regurgitation of food immediately after it has been swallowed, and a complete inability to partake of solids. These symptoms so closely resemble those that ensue from obstruction of the œsophagus that they frequently lead to an erroneous diagnosis.

In some cases the symptoms are gradually engrafted upon those of pyloric stenosis, owing to the extension of what was originally a localised growth. In these circumstances the periodic vomiting becomes more frequent, more immediately dependent upon the ingestion of food, and less profuse, until the amount of nourishment that can be taken becomes greatly reduced and regurgitation occurs immediately after swallowing. When a growth that originally obstructed the cardia progressively involves the walls of the stomach until it produces a general contraction of the organ, the initial dysphagia and regurgitation continue throughout the whole course of the complaint.

Pain is chiefly experienced when the mucous membrane undergoes superficial ulceration or the serous coat becomes inflamed and adherent to the surrounding organs. In the former case the ingestion of solid food, or even milk, gives rise to an aching or burning sensation at the epigastrium, which is relieved, though not removed, by vomiting; while in the latter constant and severe pain develops without obvious cause, and continues with a varying intensity for many weeks.

FIG. 52.—A stomach viewed from behind, showing diffuse infiltration by scirrhous carcinoma, with enlarged glands along the curvatures. (Museum of the Royal College of Surgeons.)

Cachexia is a marked symptom when pain is the predominant feature of the complaint, and is usually attributed to exhaustion. It may often be observed, however, that the vomit constantly contains small quantities of altered blood, or that signs of hæmorrhage are unexpectedly discovered when the stomach is emptied by a tube. The duration varies according to the rapidity of infiltration and the degree of contraction of the stomach. Of the cases we collected from different sources the average was ten months, while of those contained

in our own series 50 per cent. lived more than a year and 12 per cent. more than eighteen months.

The *Physical Signs* differ somewhat from those of the other varieties of the disease. Instead of presenting evidences of dilatation, the stomach becomes progressively smaller, and towards the termination of the complaint may be quite obscured by the intestines. Owing to rigidity of the gastric walls it is impossible to inflate the organ, and the gas that is introduced immediately escapes into the œsophagus or bowel. The employment of a tube is apt to confuse rather than to aid the diagnosis, since the contracted state of the stomach offers resistance to the passage of the instrument, and consequently may simulate a stricture of the œsophagus. It may usually be observed, however, that the apparent stricture is situated at a distance greater than eighteen inches from the incisor teeth, and that the fluid extracted is acid in reaction. After the administration of a test meal only a small quantity of material can be withdrawn, and from the filtrate both free hydrochloric and lactic acids are found to be absent. When vomiting is excessive the gastric fluid is usually alkaline. In about one third of the cases a rounded irregular or elongated tumour may be detected in the epigastrium or left hypochondrium, which moves with respiration and may sometimes be felt to harden and relax alternately when grasped by the hand.

(5) **The Latent Form.**—Cases are occasionally encountered in which the symptoms are either entirely absent or only appear at a late stage of the complaint. Three types of latency may be observed: (*a*) Where gastric symptoms are completely in abeyance; (*b*) Where they are replaced by those due to the cachexia or to some coexisting disease; (*c*) Where they are masked by those arising from cancerous infection of other organs.

(*a*) A *complete absence of symptoms* is very rare, and is chiefly met with in old people who are physically or mentally feeble. In such the sole indication of disease consists of general decay, associated with loss of flesh, anæmia, anorexia, constipation, and debility, and perhaps with flatulence and distension after meals. These symptoms steadily progress until the patient is obliged to take to his bed, when life slowly and almost imperceptibly ebbs away. In other instances sudden perforation (Watson), hæmatemesis (Surmont and Patoir), or hæmorrhage from the bowel (Caven) occurs, and constitutes the first

and only indication of a gastric lesion; while occasionally a casual examination of the abdomen reveals the existence of a large tumour of the stomach, the presence of which had been entirely unsuspected. Thus, Siredey relates a case in which a cancerous mass involving the pylorus and the greater curvature existed without any symptoms, while in the similar one recorded by Kepler the tumour was so movable that it was regarded as a floating spleen. In the following case the disease ran its course without exciting any suspicion of its presence.

Case VI. We attended the autopsy of an elderly gentleman who was supposed to have died from some mysterious disorder of nutrition. For nearly a year he had progressively but slowly lost flesh, and had become feeble, lacking in mental and physical energy, and very despondent. There had never been any pain, discomfort after food, vomiting, or other indication of disease of the stomach, nor could any abnormal physical signs be detected in the various organs of the body. Death had occurred very gradually from exhaustion. Upon opening the stomach an ulcerated carcinomatous growth, measuring three inches by two, was found upon the posterior surface near the pylorus. The glands along the lesser curvature were enlarged, and numerous small nodules were scattered through the substance of the liver.

(*b*) The presence of organic disease in some other important organ of the body is not only apt to mask the symptoms arising from carcinoma of the stomach, but by the prominence of its physical signs may distract attention from those that accompany the malignant complaint. Thus, in the case of a patient who suffers from cough and expectoration, and who presents the indications of lung disease, any complaint of debility, want of appetite, indigestion, or loss of flesh, will be ascribed without hesitation to the pulmonary mischief; while the existence of general œdema with albuminuria, or of anæmia with venous thrombosis, will naturally direct attention to the state of the kidneys or the blood rather than to that of the digestive organs. It consequently happens that under these and similar circumstances carcinoma of the stomach may run its entire course without exciting the least suspicion of its existence in the mind of the patient or his medical attendant.

Case VII. Phthisis: pleurisy, with effusion and thrombosis of the right common iliac vein, with latent cancer of the stomach. A woman, thirty-seven years of age, was admitted into hospital for severe cough

and expectoration of ten months' duration. She stated that during her illness she had lost more than a stone in weight, had become much debilitated, and had had frequent attacks of hæmoptysis, but, with the exception of a certain amount of flatulence after meals, had not suffered from symptoms of disordered digestion. Examination showed consolidation of the upper lobe of the right lung, with pleuritic effusion upon the same side. The temperature was elevated at night and subnormal in the morning. Six days after admission she was attacked with pain in the left side of the chest, and a loud friction sound became audible over the base of the lung. A week later she complained of severe pain in the right foot, and this was followed by œdema, coldness, and pallor of the leg and thigh. The patient rapidly lost strength and succumbed at the end of six weeks. A post-mortem examination showed extensive tubercular disease of the right lung, with recent pleurisy at the left base. About one inch from the pylorus, on the posterior wall of the stomach, there was a carcinomatous growth about the size of half a crown, which had given rise to enlargement of the glands above the pancreas and had produced several small metastases in the liver. The right femoral and common iliac veins were occluded by a thrombus.

Case VIII. General œdema: albuminuria and pleurisy with latent cancer of the stomach. A man aged fifty-four was admitted into hospital for swelling of the legs. According to his history he had suffered from inflammation of the kidneys five years before, and had since been liable to asthma, headache, and vomiting in the early morning. The appetite remained fair, the bowels were regular, and no pain or discomfort was experienced after meals. The legs, thighs, back, and face were found to be œdematous, and the abdomen was distended with fluid, but neither tumour nor tenderness could be detected. There were signs of chronic bronchitis and of effusion into the right pleural cavity. The urine was much reduced in quantity and contained a large amount of albumin and many fatty and granular casts. Death ensued from uræmia within a few days. A necropsy showed that, in addition to chronic parenchymatous nephritis, almost the whole of the stomach was affected by a cancerous growth, which had contracted the organ and given rise to metastases in the peritoneum and liver.

Case IX. Cardiac disease: no gastric symptoms, but a palpable tumour of the stomach. A woman, fifty years of age, was admitted into the London Temperance Hospital on account of urgent dyspnœa and œdema of the legs. She had suffered from rheumatic fever in early life, but had enjoyed good health until five months previously, when she began to experience shortness of breath upon exertion and to lose flesh. She had never had any pain after meals, but occasionally complained of nausea in the early morning and exhibited a

strong distaste for food. On examination the heart was found to be much dilated, and both the mitral and aortic valves were obviously incompetent. The liver was enlarged and tender, and the abdomen was distended with fluid. Treatment directed to the state of the heart led to considerable improvement, and a diminution of the ascites permitted the detection of a round and somewhat painful tumour situated immediately above and to the left of the navel. This mass increased in size and became the seat of occasional shooting pains, but there were no gastric symptoms. Death ensued quite suddenly from syncope. Post-mortem examination showed that the great curvature of the stomach was affected by a carcinomatous growth which had partially invaded the transverse colon.

(*c*) It is a common clinical observation that a rapid involvement of the liver usually masks the symptoms of the primary growth in the stomach, which is often found after death to be quite inconsiderable in size and may even have undergone partial cicatrisation. In such cases severe pain and vomiting after meals are usually absent, and the patient merely complains of nausea, distension, and flatulence. On the other hand, the hepatic affection is accompanied by constant pain in the epigastrium or right side of the chest, ascites, cachexia, emaciation, and sometimes by jaundice. The disease runs its course in five to seven months, and in the absence of a necropsy the patient is usually supposed to have died from primary cancer of the liver. The frequency with which this mistake is made is indicated by the fact that nearly one third of all cases which are diagnosed as 'cancer of the liver' are found after death to present a primary growth in the stomach.

Occasionally a patient will seek advice solely on account of symptoms arising from metastases in the lungs, pleuræ, bones, lymphatic glands above the clavicle, or even from multiple growths in the skin. In the following case all the symptoms pointed to a primary tumour of the brain, and no suspicion of malignant disease of the stomach was entertained.

Case X. Latent cancer of the stomach with a secondary growth in the brain. A man, fifty-seven years of age, was admitted into hospital for paralysis of the right arm. It appeared from his history that three months before he had fallen down in a fit, after which the arm had become weak and had sometimes been attacked with trembling. He had also suffered from persistent headache, giddiness, and occasionally from nausea, but there had been no vomiting. Examination showed much weakness of the right hand and forearm,

with slight wasting of the muscles. There was also well-marked double optic neuritis. Death occurred suddenly about a fortnight later. At the necropsy the pylorus was found to be adherent to the under surface of the liver, and presented on its inner surface a large ragged cancerous growth, which had given rise to a few secondary deposits in the liver. There was a secondary nodule in the posterior part of the corpus callosum on the left side, with recent hæmorrhage into its substance.

(6) **The Ascitic Form.**—In this variety an abundant exudation of fluid takes place into the peritoneal cavity, which masks the signs and symptoms of the primary lesion and gives rise to considerable difficulty of diagnosis. In the great majority of cases the effusion is due to secondary carcinosis of the peritoneum, but occasionally it may arise from the pressure exerted by a nodule of growth or an enlarged gland upon the portal vein. The following examples serve to illustrate the symptoms presented by cases of this description.

Case XI. A woman, fifty-three years of age, was admitted into hospital under our care for ascites. She stated that about two months previously she had noticed a sensation of weight and fulness in the abdomen, which was somewhat increased after meals, and gave rise to difficulty of breathing. Within the course of a week or two the body began to swell and the dyspnœa became greatly aggravated. She had never suffered from pain or vomiting after food, but had latterly lost a great deal of flesh and had grown very weak. On examination the abdomen was found to be greatly distended, and there was some enlargement of the superficial veins. There was a well-marked thrill on palpation, but the percussion-note was dull all over and no evidence of floating intestine could be detected. Owing to the urgency of the symptoms, paracentesis was performed, and 246 ounces of clear fluid were withdrawn. Palpation then revealed a hard nodular tumour of oblong shape, which was situated across the epigastrium, about an inch above the navel, and was slightly movable with respiration. There was no enlargement of the liver or other indication of visceral disease. Three days later the fluid had re-accumulated and tapping was again performed, but the patient rapidly sank and died from cardiac failure within a week.

Necropsy. The peritoneum was covered with small circumscribed masses of carcinoma, which varied from the size of a millet-seed to that of a pea. The great omentum was infiltrated, and formed a sausage-shaped roll across the anterior surface of the stomach, to which it was adherent. Situated upon the posterior wall of the stomach, near the cardia, was a large ulcerated growth, which had extended into the substance of the pancreas. The other viscera were healthy.

It will be observed that in the foregoing case the patient complained solely of distension of the abdomen with difficulty of breathing, and had never suffered from any symptom indicative of cancer of the stomach. It may therefore be concluded that the gastric complaint had remained latent until the invasion of the peritoneum had given rise to ascites. In the next case the peritoneal effusion was preceded by sufficient gastric disturbance to permit of an accurate diagnosis being made during life.

Case XII. A man, forty-one years of age, stated that for two months he had suffered from pain after meals, flatulence, and oppression at the chest. He had also vomited occasionally, but had never brought up any blood. The indigestion had been accompanied by loss of appetite and progressive debility, but he did not think that he had lost much flesh. A week before he came to the hospital he had been suddenly seized with stabbing pain in the abdomen, which caused him to feel sick and ill, after which the stomach began to swell. On admission the abdomen was uniformly enlarged, and the superficial veins were more prominent on the right than on the left side. When he lay upon his back the signs of ascites were very obvious, but percussion over the umbilical region elicited a dull note instead of the tympanitic resonance due to floating intestine. It was also observed that the right loin was dull posteriorly, while on the left side the percussion-note was resonant from the lower ribs to the crest of the ilium. No tumour could be felt even after the evacuation of several pints of fluid. Although paracentesis afforded considerable relief, the patient's strength rapidly failed, and he died at the end of six weeks.

Necropsy. There was considerable ascites present. The colon, small intestines, great omentum, and stomach were united into a mass which was attached to the spine on the left side. The whole of the peritoneum was much thickened and covered with miliary carcinoma. The stomach was contracted and its walls greatly thickened by scirrhous infiltration, but the pylorus was not affected nor was the mucous membrane ulcerated.

Among the clinical records of the London Hospital of the last twenty years we have discovered fourteen cases in which ascites constituted the sole indication of cancer of the stomach. In six of these progressive enlargement of the abdomen, followed by œdema of the legs, was the first symptom to attract the attention of the patient; in six the ascites had been preceded for a month or two by pain or discomfort after

meals, flatulence, and vomiting; while in the remaining two the gastric and peritoneal symptoms appeared to develop at the same time. It may therefore be concluded that in at least one half of all cases there is no evidence to connect the ascites with a malignant growth of the stomach.

As the disease progressed pain and distension of the abdomen, accompanied by shortness of breath and palpitation, were invariably present, but only in one third of the cases was there any complaint of pain after food or vomiting. The temperature was subnormal in every instance except one, where the peritonitis was ushered in with slight fever. A palpable tumour existed in four cases, and in each instance it was found to be due to infiltration of the great omentum. In the remainder the peritoneum was affected with miliary cancer, and the stomach was situated too deeply to be detected by palpation. Effusion into the pleura occurred in one third of the cases, and was more frequent on the left than on the right side. In one case the pericardium became inflamed immediately before death. In every instance the ascites was considerable in amount, recurred rapidly after paracentesis, and as a rule the contraction of the mesentery caused the intestines to be covered by fluid, so that the anterior aspect of the abdomen was dull instead of resonant on percussion. Occasionally adhesion of the bowel to the spine or the kidney gave rise to a tympanitic note over the lumbar region. Cases of this description run their course with great rapidity, for we find that the average duration of life in those of our series was only seventeen weeks.

(7) **The Dyspeptic Form.**—This occupies an intermediate position between the latent and the ordinary varieties of the disease. It is characterised by the presence of dyspeptic symptoms resembling those of an inflammatory or nervous affection of the stomach, which no form of treatment will relieve and which are accompanied by progressive loss of flesh and strength. Pain after food is rarely complained of, but there is a constant sense of uneasiness, discomfort, or distension, which is increased by liquid as well as solid food, and is attended by anæmia and obstinate constipation. Nausea is often present in the early morning or after meals, but vomiting seldom occurs and hæmatemesis is exceptional. At a late stage of the complaint, however, a small quantity of altered blood may sometimes be extracted from the stomach. Ex-

amination of the gastric contents after a test meal shows a marked deficiency or entire absence of free hydrochloric acid, but lactic acid may not exist until shortly before death. Careful examination usually reveals a moderate degree of dilatation of the stomach, and not infrequently a tumour in the region of the pylorus. Owing to the insidious nature of the complaint, life is often prolonged for a considerable period, and we have met with several cases where the persistent and progressive character of the symptoms seemed to indicate a duration of three or four years. In other instances involvement of the pylorus or cardiac orifice by the growth leads to the development of periodic vomiting or dysphagia, which soon brings life to an end.

It is worthy of notice that the occurrence of pregnancy almost invariably gives rise to excessive vomiting, which no treatment will allay, and which does not subside even after the induction of abortion.

(8) **The Anæmic Form.**—It has long been known that certain cases of carcinoma of the stomach are attended from an early period by an extreme degree of anæmia, the symptoms of which take precedence of those arising from the gastric lesion and occasion considerable difficulties in diagnosis. A careful consideration of the various cases of this description which have come under our notice has convinced us that at least three varieties of anæmia may accompany the onset of the malignant disease, each of which is attended by definite alterations of the blood. The first and most usual type is that in which the anæmia is the result of internal hæmorrhage, which, owing to the absence of vomiting, has remained unrecognised. In the second class are included those cases where the blood so closely resembles that of pernicious anæmia that from a clinical standpoint the two complaints may be said to coexist. The third group comprises those rare instances in which enlargement of the spleen and the presence of an excess of leucocytes in the blood simulate leucocythæmia.

(*a*) *Anæmia due to Concealed Hæmorrhage.*—This is by far the most common variety, and is often associated with a localised malignant ulcer of the posterior surface of the stomach. After a comparatively short period of ill-health the patient loses colour in the face and lips and complains of shortness of breath, thirst, and great debility. Not infrequently these symptoms develop

suddenly after a sharp attack of abdominal pain or diarrhœa, which is attributed to indulgence in fruit or some indigestible article of diet. Contrary, however, to expectation, the symptoms increase rather than diminish, the anæmia gradually becomes more pronounced, and there is faintness, giddiness, or palpitation upon the least exertion. The appetite is greatly diminished, there is a steady loss of flesh, and in the majority of cases discomfort and flatulence are experienced after every meal. The subsequent progress of the disease is variable. In some instances the anæmia steadily increases and is attended by the usual symptoms of cardiac failure; or sudden exacerbations of weakness and debility occur at irregular intervals, and are accompanied by excessive pallor. In other cases severe pain after food is experienced, and is followed by vomiting, anorexia, and eventually by hæmatemesis. During the first few months physical examination throws little light upon the nature of the complaint. With the exception of a somewhat feeble impulse, and perhaps of a murmur over the pulmonary area, the heart appears to be healthy, and the lungs are quite normal. The pulse is small and of low tension, the temperature is slightly elevated at night, and there may be œdema of the ankles. No enlargement or tumour of the stomach can be detected, and the urine is quite healthy. After a time, however, increasing pain is experienced in the epigastrium or right hypochondrium, the temperature remains permanently subnormal, emaciation proceeds rapidly, the liver becomes enlarged, and ascites or jaundice develops. In other instances the pain after food and vomiting become excessive, the stomach undergoes dilatation, and a growing and painful tumour is detected in connection with the viscus. An early diagnosis can be made only by examination of the contents of the stomach. For this purpose a soft tube is passed into the organ during the period of digestion, when the evacuated material is found to contain altered blood, sometimes in considerable quantity. Free hydrochloric acid is invariably absent, but lactic acid may not exist until a late stage of the disease. Examination of the blood shows a great reduction in the number of red corpuscles and of hæmoglobin, but an absence of poikilocytosis. The average duration of life is about eight months.

Case XIII. A man aged forty-nine was admitted into the London Temperance Hospital for anæmia. He stated that he had enjoyed

excellent health until about five months previously, when he noticed that he had grown very pale and was short of breath on exertion. The appetite was poor and he was very thirsty at night. These symptoms continued to increase, and he also steadily lost flesh and became very weak. After meals containing solid food he often felt a sense of oppression at the chest, but there had been no actual pain or vomiting. On examination he was found to be profoundly anæmic and very wasted. The pulse was small and feeble, the temperature elevated about a degree and a half at night, and the tongue was pale, flabby, and indented by the teeth. The stomach was slightly increased in size, and pressure over the epigastrium produced discomfort and nausea, but no resistance or tumour could be detected. The bowels were confined. There was slight œdema of the ankles, but the urine contained neither sugar nor albumin. The red corpuscles were reduced to 54 per cent. of the normal and the hæmoglobin to 44 per cent. There was no excess of leucocytes or poikilocytosis. After a test breakfast about ten ounces of thick brownish-black material was removed from the stomach by the tube, which was found to consist of undigested food, mucus, and altered blood, but contained neither free hydrochloric nor lactic acid. The following day the tube was again passed before any food had been given, and several ounces of alkaline blood-stained fluid were removed. On several subsequent occasions altered blood was discovered in the stomach during the periods of digestion, but no melæna was ever observed. Despite careful treatment the patient grew rapidly weaker, and eventually succumbed to exhaustion about six and a half months after the appearance of the first symptoms. Post-mortem examination showed a large ulcerated scirrhous growth on the posterior wall of the stomach, near the pylorus. The orifice was not involved, nor were there any metastases in the neighbouring organs.

Case XIV. A middle-aged man was admitted into hospital under our care on account of debility and loss of flesh. The first symptoms of ill-health had consisted of breathlessness, weakness of the legs, and flatulence after food, with great distaste for meat. The bowels were confined, and nausea with occasional vomiting had been experienced in the early morning. Examination showed the patient to be profoundly anæmic and emaciated. The lower border of the stomach reached to the level of the umbilicus, and pressure over the centre of the epigastrium gave rise to pain. There was no tumour, and the other viscera of the body were healthy. The corpuscular richness of the blood was 54 per cent. of the normal and that of the hæmoglobin 48 per cent. There was also a slight excess of leucocytes. After a test meal the contents of the stomach were found to be devoid of free hydrochloric acid, but to contain an excess of lactic acid.

For nearly a fortnight the patient showed signs of improvement and gained half a pound in weight, but at the end of that time he grew suddenly worse and the anæmia became much more pronounced. Exploration of the stomach after the midday meal led to the evacuation of a large quantity of altered blood. From this hæmorrhage he gradually rallied, but began to complain of pain after food, which grew more severe and was also troublesome at night. The liver became enlarged, and a hard tender tumour developed under the right costal margin. Six weeks later the liver extended nearly to the umbilicus, and presented several discrete tumours in the substance of the right lobe. Ascites occurred and was followed by jaundice, and the patient fell into a comatose state, which terminated fatally in three days.

Necropsy. The liver was extensively infiltrated with soft carcinoma, and several nodules presented recent hæmorrhages. Near the lesser curvature of the stomach, in the posterior wall, there was an ulcerated growth of cylinder-celled carcinoma about the size of a two-shilling piece.

(*b*) *Profound Anæmia with Blood Changes similar to those of Pernicious Anæmia.*—Cases of this description are much rarer than those of the preceding group. The onset of the complaint is insidious, and characterised by progressive pallor of the skin and mucous membranes, which subsequently changes to the lemon tint so often observed in idiopathic anæmia. At the same time the patient suffers from loss of appetite and thirst, and becomes markedly emaciated and feeble. Gastric symptoms are almost always present, but vary from occasional attacks of discomfort and flatulence to severe pain and vomiting after each meal. The bowels are usually confined, but at a late stage of the disease diarrhœa is apt to alternate with constipation. In most cases the temperature is elevated at first, but subsequently remains subnormal. Thrombosis is apt to occur in the veins of the lower extremities, and pneumonia is often the immediate cause of death. Examination of the stomach seldom affords any distinctive evidence of disease, since the growth usually occupies the central region of the organ. At a late stage, however, gastric dilatation may be observed, or a tumour may develop. In every instance the gastric contents are devoid of free hydrochloric acid, but the presence of lactic acid and of the Oppler-Boas bacillus is variable. The blood is very pale and exhibits a great diminution of red corpuscles, with poikilocytosis, and sometimes nucleated red cells and megaloblasts. Occasionally retinal hæmorrhages develop, or bleeding

takes place from various mucous membranes or into one of the serous cavities (Bouveret). Death usually occurs within nine months.

Case XV. A man about fifty years of age was admitted into hospital for 'pernicious anæmia.' He stated that his health had been failing for seven months, during which time he had lost nearly two stones in weight and had become extremely weak. He had also grown very pale, and found that the least exertion gave rise to breathlessness and palpitation. The appetite was very bad, and after meals he had suffered from distension of the stomach, nausea, and flatulence. There had never been any vomiting or hæmatemesis, and the bowels were constipated.

Examination showed him to be very emaciated. The eyelids were puffy, the lips and conjunctivæ pallid, and the skin a pale lemon colour. There was marked œdema of the ankles. No signs of pulmonary disease could be detected, but there was a loud systolic bruit over the base of the heart on the left side. The stomach extended to the level of the navel, and pressure over the epigastrium gave rise to pain, but no tumour or resistance could be felt. The other organs were apparently healthy. The blood showed red corpuscles 26 per cent., hæmoglobin 19 per cent., well-marked poikilocytosis and a few typical megaloblasts. The gastric contents were devoid both of free hydrochloric and lactic acid. During his residence in the hospital the gastric symptoms increased, and on several occasions he vomited after meals. Emaciation made rapid progress, and the anorexia became absolute, so that the greatest difficulty was experienced in the administration of food. The temperature was slightly elevated at night but subnormal in the morning, and from time to time the constipation was replaced by diarrhœa. A few small hæmorrhages also developed in the retina of the right eye. Death occurred suddenly from syncope at the end of three weeks. At the necropsy the greater part of the posterior surface of the stomach was found to be affected with an exuberant soft growth of spheroidal-celled carcinoma, which had given rise to a small encysted collection of pus behind the organ. The glands along the lesser curvature were enlarged, but there were no metastases in the liver or other organs.

(*c*) *Anæmia with an Excess of White Corpuscles in the Blood.* Alexandre and other writers have described cases of carcinoma of the stomach in which the symptoms of severe anæmia were associated with a great excess of white corpuscles (leuchæmia). Three cases of this description are included in our hospital series, and in each instance the spleen was much enlarged.

The first symptoms of ill-health consisted of breathlessness on exertion, debility, palpitation, and discomfort after meals, and the patients subsequently complained of loss of flesh, want of appetite, and at a later period of pain after food and repeated vomiting. In two cases the stomach underwent considerable dilatation, and a tumour was detected in the epigastrium, but in the other no special signs of the gastric complaint existed during life. In each the spleen was easily palpable, but it never projected more than three inches below the costal margin, and was not accompanied by enlargement of the lymphatic glands. Free hydrochloric acid was absent in the only case where the result of an examination of the gastric contents was recorded, and in every instance, in addition to a diminution of the red corpuscles, there was a marked increase in the number of white cells, the ratio of red to white varying from 70 to 1 to 12 to 1 Thrombosis of the femoral, iliac, or popliteal veins invariably occurred before death, and two cases succumbed to pneumonia. The average duration of life was about eleven months. It is interesting to note that in only one out of the three cases was a correct diagnosis made during life, the other two being regarded as examples of leucocythæmia.

Case XVI. A woman, thirty-three years of age, had complained of weakness, dyspnœa, and palpitation for nearly six months. When admitted into hospital she was markedly anæmic and thin, and exhibited a great distaste to food. The spleen was considerably enlarged, and the blood showed a vast excess of white corpuscles, the proportion of red to white being 26 to 1. The stomach was slightly dilated, and in the epigastrium an ill-defined tender tumour could be felt. About a week later she was attacked by thrombosis of the left femoral vein, and subsequently by pneumonia, which terminated fatally. After death cancer of the pylorus and lesser curvature was discovered, with secondary disease of the great omentum. The spleen was large, firm, and pale, but did not contain any secondary growths.

Case XVII. A man, aged fifty-six, was admitted into hospital for anæmia. The history was very indefinite, but he had apparently been out of health for four months, and had become too weak to pursue his work as a general labourer. There was no complaint of pain or sickness, but he had become greatly emaciated and was very short of breath. On examination he presented profound anæmia, with œdema of the ankles and a pleuritic effusion on the left side. The spleen projected three inches below the costal margin, but the organ was not

tender and its surface was quite smooth. The patient had never suffered from malaria. Just to the right of the navel was a round, movable, tender tumour about the size of a Tangerine orange, apparently connected with the stomach, which was somewhat dilated. The gastric contents were free from hydrochloric acid, and the blood contained a great excess of white corpuscles. On several occasions the patient vomited after dinner, but there was no hæmatemesis. Pain and swelling of the left leg developed, the temperature rose to 100° F., and the general debility increased. Death occurred from exhaustion within four weeks. A necropsy showed carcinoma of the pylorus with slight contraction of the orifice, a few secondary growths in the pancreas, and a large but apparently healthy spleen.

(9) **Carcinoma originating in Simple Ulcer (Ulcus Carcinomatosum).**—The frequency with which cancer of the stomach is preceded by a simple ulcer is a matter that has given rise to much discussion. According to Lebert, about 9 per cent. of all gastric carcinomata originate in the benign complaint; Sonicksen's estimate is 14 per cent., Rosenheim's 6 per cent., Plange and Berthold's 3 per cent., Steiner and Wollmann's 4 per cent., while Zenker seems to regard simple ulceration as a necessary antecedent to the malignant affection. Personally, we are inclined to agree with Häberlin that only about 3 per cent. of all cases of gastric cancer present a clinical history or post-mortem evidence of previous ulceration.

Since 1845 about thirty-two examples of the disease have been published, and although a critical examination of many of the cases tends to throw considerable doubt upon their authenticity, several facts of importance may be gleaned from them. As might have been expected from the etiology of the simple complaint, women are more often affected than men (20 : 12), and the pyloric end of the stomach is almost invariably the seat of the growth. As a general rule, the symptoms of the malignant disease are gradually engrafted upon those of the chronic ulcer, but in about one fifth of the cases an interval varying from a few months to several years existed between the apparent healing of the ulcer and the development of the neoplasm. A careful perusal of the recorded cases seems to indicate that the carcinoma *ex ulcere* may be divided into three classes.

In the first group the indications of malignant mischief steadily develop, and finally predominate over those of the

ulcer; in the second they remain latent throughout, while the pain, vomiting, and hæmatemesis of the primary disease continue until the end; while in the third all gastric symptoms remain in abeyance, and the physical signs indicate cancer of the liver, peritoneum, or pancreas.

(*a*) *Cases in which the Symptoms of Carcinoma are engrafted upon those of Simple Ulcer* constitute about 80 per cent. of the entire number. When the indications of an ulcer have persisted up to the time of its malignant invasion, they gradually become aggravated, pain and vomiting are excited by liquid as well as by solid food, and a constant sensation of nausea may be present. On the other hand, the appetite may continue good for several months, or even persist until the end. Attacks of pyrosis are apt to occur at night, loss of flesh takes place rapidly, and debility and cachexia are always prominent features of the complaint. Severe hæmatemesis is rare, but small quantities of altered blood are sometimes observed in the vomit or in the material extracted from the stomach by a tube. After a period varying from three to six months the appetite declines, the debility and emaciation make rapid progress, and the patient grows very depressed, and often expresses a conviction that his disease will prove fatal. The last phase is marked by complete anorexia, extreme asthenia and cachexia, and intolerance of any kind of food. The physical signs of malignant disease are very indefinite. The epigastric tenderness which had attended the simple ulcer is sometimes intensified, but in the absence of secondary growths in the omentum a tumour can rarely be detected. Owing to the fact that the neoplasm usually remains localised, the signs of pyloric stenosis are wanting, and it is rare for the liver to present palpable growths or for the glands above the left clavicle to become enlarged. The results of an exploration of the stomach are also equivocal, since the pre-existing hyper-secretion usually persists for several months after the onset of the carcinoma, and may continue until the end. As a rule, however, the secretion of the mineral acid gradually fails, and after a few months lactic acid, with or without the Oppler-Boas bacillus, may be detected in the gastric contents.

When carcinoma attacks an ulcer which has undergone cicatrisation, or which has remained latent for some time, it is much less difficult to recognise. The patient usually imagines that

her old malady has recurred, and seeks medical advice on account of renewed pain or discomfort after food, and vomiting. It is observed, however, that, unlike the simple complaint, there has been a steady loss of flesh and strength from the onset of the dyspeptic symptoms; anæmia soon becomes a prominent feature, and the blood exhibits a steady diminution of red corpuscles and hæmoglobin. The appetite is also affected at an early period, and complete anorexia is sometimes established after a few months. The gastric symptoms increase in severity, and if the growth involves the tissues surrounding the scar, as it usually does, the pylorus is apt to become obstructed and to give rise to periodic vomiting. This variety is more often accompanied by the presence of a tumour than the preceding, and in most instances the liver or peritoneum shows signs of invasion before death. The gastric contents vary according to the situation of the former ulcer; but unless it was located in the immediate vicinity of the pyloric orifice, hyper-secretion is usually absent, and free hydrochloric acid is replaced by lactic acid at an early period of the complaint.

Case XVIII. A man, forty-eight years of age, was admitted into hospital under our care in 1887 for a chronic ulcer of the stomach. For more than a year he had complained of pain and sickness after meals, and on two occasions had vomited a large quantity of blood. Under treatment these symptoms eventually subsided, and he apparently became cured. In 1890 he again sought admission into hospital for severe indigestion. According to his statement he had been perfectly free from pain for more than a year, when, after a few weeks of ill-health, he began to experience a sense of weight and oppression at the chest after meals, attended by flatulence, nausea, and want of appetite. During the last two months he had lost much flesh and felt very weak. There had been no vomiting or hæmatemesis. On examination he was found to be very thin and markedly anæmic. The stomach was somewhat dilated, and pressure over the region of the pylorus gave rise to pain, but no tumour could be discovered. The temperature was subnormal, the urine healthy, and the blood showed a great reduction in the number of red corpuscles and of hæmoglobin, with slight leucocytosis. After a test meal the contents of the stomach gave the reaction for free hydrochloric acid, but were free from lactic acid. For two or three weeks a milk diet was attended by improvement, but subsequently the discomfort after meals increased and vomiting occurred each night. The patient continued to lose flesh and strength, and on two

occasions exploration of the stomach with a tube revealed the existence of altered blood in the organ. Free hydrochloric acid disappeared about the fifth month of the disease, but no lactic acid was ever detected. Shortly afterwards he was attacked by pneumonia, to which he succumbed.

Necropsy. On the posterior wall of the stomach, about two inches from the pylorus, was a chronic ulcer the size of a five-shilling piece. Growing from its lower margin and base was a large firm growth of greyish-brown colour, which on microscopical examination proved to be a spheroidal-celled carcinoma. The lymphatic glands along the lesser curvature and behind the stomach were enlarged, but there were no metastases in the liver or other organs.

Case XIX. A woman, aged thirty-five years, was admitted into the Westminster Hospital on April 12, 1900, suffering from what was supposed to be a gastric ulcer. She stated that in 1894, about a month after the birth of her first child, she had pain in the chest and back, coming on soon after food and relieved by vomiting, but unattended by hæmatemesis. This lasted for three and a half years, when the symptoms subsided, and for six months she suffered from no discomfort or inconvenience. A month before the second child was born she had another attack, which lasted nine months, during which time she frequently brought up blood, but never in large quantities. About sixteen months ago she again became pregnant, and since then had suffered constantly from gastric symptoms. The pain after meals had become more pronounced and the vomiting more frequent. She stated that, with intermissions, her illness had lasted for six years, and during the last two years she had lost flesh considerably.

On admission the patient was found to be very thin, but she presented no cachectic appearance; her weight was five stones eight pounds. She complained of a feeling of oppression in the epigastric region, culminating in acute pain after food and relieved by vomiting. The vomited matter consisted of undigested food with a quantity of yellow frothy fluid having an acid reaction. There was very little abdominal tenderness, the stomach was only slightly dilated, and there was some thickening about the pylorus. The temperature was normal, and the urine had a specific gravity of 1020 and contained no albumin.

The patient was kept in bed and was placed on three pints of peptonised milk—five ounces every two hours—with plasmon custard; but the vomiting was so persistent that nutrient enemata with suppositories of beef peptones were substituted. These suppositories contained 50 per cent. of peptone of beef, and each weighed 72 grains. The bowels were relieved from time to time by a simple enema. On this treatment she progressed favourably until May 14, when there was a sudden rise of temperature. At 7 A.M. it was 103·4° F., and at 3 P.M.

it was 104·6°, the pulse being 136. There was no sore throat, or pneumonia, or endocarditis, and apparently nothing to account for it. She was put on small and frequently repeated doses of tincture of aconite, and on the following day the temperature fell to 100° F., although henceforth it was never quite normal and ranged from 100° to 101° F. On the 16th she started an attack of diarrhœa, which proved extremely obstinate and continued until her death. There were often from ten to twelve evacuations in the twenty-four hours. The motions were loose, but not watery; they were small and greenish-brown in colour, not slimy, but very offensive. Various modes of treatment were tried, without avail, including saturated solution of camphor in alcohol (three drops every five minutes) drachm doses of carbonate of bismuth every four hours, enemata of opium (fifteen drops of the tincture in two ounces of mucilage of starch), and from time to time pill of lead and opium. That these remedies were ineffectual is shown by the fact that she had 103 motions in twenty days, exclusive of those which were too small to note. Once or twice the stools were dark in colour and contained what was apparently broken-up clot. The patient gradually lost ground, and early in May a small nodular mass was felt to the right of the middle line, midway between the umbilicus and the ensiform cartilage. The stomach was dilated, but not markedly so. On May 26 it was obvious that she was critically ill. She was losing flesh rapidly and was too weak to get out of bed. There was considerable anæmia, and the face looked almost as if it were jaundiced, although the conjunctivæ were white. She was in no pain but took very little nourishment. The tongue was moist and tremulous, and there were streaks of fur in the centre. The diarrhœa continued, and there was prolapse of the rectum. There was no albumin or sugar in the urine. The stomach was more dilated, but the liver was not enlarged.

Necropsy. At the necropsy the stomach was found to be adherent about the pylorus to the liver. It was dilated, and at the pylorus there was an ulcer consisting of two distinct parts. One, which was directed towards the stomach, was cicatrised, and this was adherent to the liver; and the other, directed towards the pylorus, was fungoid in appearance. The two ulcers together were of about the size of a five-shilling piece. There were enlarged glands in the portal fissure and in the neighbourhood of the growth. There were no secondary deposits in the liver, which was fatty. The intestines showed melanic contents in places, and the villi were atrophied. The spleen, adrenals, pancreas, kidneys, bladder, uterus, and ovaries were normal. Microscopical examination of the growth showed that the condition was one of spheroidal carcinoma. The muscular tissue about the pylorus was being invaded by a growth poor in cells and suggesting scirrhus. *Recorded by Dr. Murrell.*

(*b*) In about 15 per cent. of the cases *the symptoms of gastric ulcer continue prominent throughout the whole course of the complaint.* Pain is experienced after every meal, whether it be composed of liquids or solids, and in many instances there is a marked intolerance of milk. Vomiting occurs frequently, and is often particularly troublesome at night, while from time to time attacks of excessive retching supervene, which persist for several days and preclude the administration of food by the mouth. Pyrosis is almost always a source of complaint, and extreme thirst may be present. As a rule, the appetite gradually diminishes or is replaced by an intense craving for food, which disappears after a few mouthfuls have been swallowed. Loss of flesh is invariably a marked feature of the case, and the patient becomes exhausted after the least exertion. Profuse hæmatemesis is also apt to occur, and may prove fatal, while occasionally life is suddenly cut short by perforation of the stomach. Examination of the abdomen rarely affords any evidence of carcinoma, since a tumour and secondary growths are seldom encountered, while any dilatation of the stomach which may exist is usually ascribed to the ulcer. The gastric contents usually exhibit an excess of free hydrochloric acid for several months, and not infrequently the signs of hyper-secretion continue until the end. Cases of this description are extremely difficult to diagnose, and it is only by noting the disproportionate loss of flesh and strength, and perhaps a steady diminution in the secretion of hydrochloric acid, that a cancerous invasion of the ulcer can even be surmised.

(*c*) *Complete latency of the gastric symptoms with a precocious development of secondary growths in the liver or peritoneum* occurs in only about 5 per cent. of the cases. In such the ulcer of the stomach appears to undergo cicatrisation, but leaves behind it a tendency to flatulence and distension after meals, with an enfeebled appetite and great weakness. After this condition of ill-health has continued for some months attention is again attracted to the abdomen, either on account of pain in the chest or back, accompanied by signs of enlargement of the liver, or by the development of ascites. As soon as these signs show themselves emaciation progresses rapidly, pain or vomiting is experienced after meals, and the disease runs its usual course.

(10) Carcinoma of the Stomach in Early Life (Acute Carcinoma).—The rare occurrence of gastric cancer before the age of thirty has already been noticed (p. 88). Without much trouble we have been able to collect twenty-two cases in which the complaint developed between thirteen and thirty years of age, and to them we have added three of our own. Of these twenty-five examples, twenty-one were males and four females. In most instances the growth was described as encephaloid or scirrhus, and from those where the microscopical features of the disease were recorded it would seem that the cylinder-celled variety is comparatively infrequent.

In sixteen cases the first symptoms appeared quite suddenly, and became pronounced within two or three weeks, while in the rest there was a history of antecedent ill-health which varied in duration from ten days to two months. Pain in the region of the stomach existed in all but three cases, and was usually increased by food, while vomiting occurred in every instance except two, and was often a prominent feature. Anorexia was a less conspicuous symptom, and in fourteen instances did not appear until a late period, while in six a desire for food continued until a few days before death. Fever existed in four cases, and in two continued for several weeks. In every instance there was rapid emaciation and anæmia, and in five ascites developed at an early stage, owing to implication of the liver or peritoneum. An abdominal tumour or enlargement of the liver was detected in nineteen out of the twenty-five cases. It is important to note that carcinoma of the stomach in early life usually runs an acute course, the average duration of the disease in our cases being three months, while in more than one half it did not exceed nine weeks. The conclusions arrived at by Mathieu from an analysis of twenty-seven cases were of a similar nature.

CHAPTER VIII

COURSE, DURATION, AND PROGNOSIS

Course.—It is impossible to describe in any but general terms the course pursued by carcinoma of the stomach. Not only do the symptoms vary in intensity at different periods, but those which were at first most conspicuous often disappear after a few months, while others, that depend upon the fortuitous involvement of a neighbouring organ or upon structural changes in the growth itself, develop with startling rapidity and may completely change the clinical aspect of the case. But, in spite of every alteration in the symptomatology or physical signs, one fact usually stands out conspicuous and unmistakable—improvement is rare and always transitory, and the health of the patient steadily declines.

Among the special symptoms of the disease, *pain* usually exhibits the greatest variation, being apt to subside spontaneously after the liver has become involved, to be relieved by hæmorrhage or a change of diet, and to alter in character and time of onset when the growth undergoes ulceration.

Vomiting as an early symptom is chiefly encountered in stricture of the orifices. In disease of the cardia the dysphagia and regurgitation of food steadily increase until the obstruction becomes almost absolute, but in pyloric cases the periodic attacks of emesis are often interrupted from time to time by symptoms of acute gastritis, which persist for several days and may give rise to fatal exhaustion.

Spontaneous cessation of vomiting often occurs shortly before death, but it may ensue at an earlier period, owing to sloughing of the growth which caused the obstruction or to the establishment of a fistulous communication with the intestine.

As a rule the *anæmia* develops gradually, and repeated examinations of the blood show a slow but steady diminution of hæmoglobin and red corpuscles. Occasionally, however,

cachexia develops rapidly, and attains within a few days the degree which it usually takes months to produce, or a sudden increase of pallor occurs at irregular intervals. In such cases it is a fair assumption that ulceration of the growth has been accompanied by internal hæmorrhage, which, owing to the absence of a systematic examination of the evacuations, had escaped attention.

Emaciation varies in degree in different cases, but is always progressive. It is most rapid in cases of stricture of the cardiac or pyloric orifice, and in those where anorexia and vomiting are early and prominent symptoms. The loss of flesh is comparatively slow when a non-ulcerated growth occupies the wall or gradually infiltrates the entire stomach.

Temporary increase of weight is often observed in cases of pyloric stenosis which are subjected to lavage and careful feeding, and after the performance of an exploratory laparotomy or gastro-enterostomy. Renewed hope also exercises a beneficial influence upon the general nutrition, so that a patient who is assured of recovery by a new medical attendant will often regain appetite and weight for several weeks. A fictitious increase of weight usually accompanies an effusion of fluid into the peritoneal or pleural cavities, general œdema, or a rapid infiltration of the liver.

Although the course of carcinoma of the stomach depends to a great extent upon the situation of the disease and the various complications incidental to its development, there can be little doubt that it is also largely influenced by the rate of growth of the tumour at different times. In every case there probably exist certain periods of latency, the duration of which varies according to the structure of the neoplasm, its location in the stomach, and the vulnerability of the tissues. Thus, there is every reason to believe that an appreciable interval always exists between the commencement of the carcinoma and the appearance of the first symptoms of disordered digestion, which is comparatively short when a medullary or cylinder-celled growth affects the cardia or pylorus, but is often protracted in the case of a localised scirrhus of the body of the viscus. Again, it frequently happens that after the disease has pursued an acute course for the first few months the urgent symptoms abate, the rate of emaciation diminishes, and life is prolonged for many months beyond the period originally anticipated. In such it is

usual to find after death either that the primary growth presents evidence of partial repair, or that it is largely composed of fibrous elements, which indicate a retrograde activity. On the other hand, cases are often met with in which, after a period of slow development, the pain, vomiting, and cachexia undergo a sudden exacerbation, the liver becomes rapidly affected by metastases, and life is cut short in a few weeks, while a necropsy shows extensive sloughing of the tumour or an exuberant growth at the edge or base of a scirrhous induration. Whether these variations of malignancy depend upon local or constitutional conditions it is impossible to say, but the fact remains that, except under certain circumstances, the course pursued by the disease is essentially irregular, and consequently impossible to predict.

Duration.—The duration of carcinoma of the stomach is very difficult to determine. It has been shown that the onset of the symptoms rarely, if ever, coincides with the actual commencement of the morbid growth, and that no limit can be assigned to this period of latency. The initial phenomena of the disease are also so variable that the degree of indisposition necessary to attract attention may in one case develop within a few weeks, while in another it is delayed for several months. The personal equation, again, is always a factor of great importance, some individuals being affected by a nervous disposition which causes them to seek advice immediately they suffer from indigestion, while others continue to pursue their usual avocations until compelled to relinquish them by excessive debility. The same influence becomes evident when an attempt is made to elicit the history of the illness, the one class being wont to confuse antecedent and extraneous symptoms with those of malignant disease, while the other tend equally to obscure the issue by denying the existence of ill-health before the occurrence of those symptoms of which they immediately complain. These various sources of error are naturally predominant in statistics based upon hospital practice, where patients seldom apply for treatment until the disease has already made considerable progress,[1] and who, from want of education, can rarely give an accurate account of the development and course of their illness. Even the period at which the tumour made its appearance can-

[1] In our own cases the average duration of the disease at the time of the patients' admission into hospital was five months.

not be relied upon, since it is usually discovered by accident after it has already attained a considerable size. Nor is the specialist engaged in private practice able from his own observations to determine the usual duration of the malady; for although he may be able to obtain a fairly accurate history from his patients, the subsequent course of their illness is always difficult, and often impossible, to ascertain. Finally, the general practitioner, who alone possesses the opportunity of studying the disease from beginning to end, seldom sees a sufficient number of cases to allow him to deduce any definite conclusions from them. It is therefore obvious that all the statistics which we at present possess can only afford a rough idea of the average duration of the complaint.

From the study of 198 cases Brinton estimated the average duration of cancer of the stomach at twelve and a half months; Lebert considered it to be fifteen months, with a maximum of four years; while Katzenellenbogen placed the usual duration at eighteen months. In our own series 83 per cent. died within twelve months, 11 per cent. between twelve and eighteen months, and about 6 per cent. between eighteen months and two and a half years. In the following table our results are compared with those of Lebert and Osler and McCrae.

TABLE 28.—THE DURATION OF CARCINOMA OF THE STOMACH

Time of death	Percentages of cases		
	Authors'	Lebert	Osler and McCrae
One to three months	18·4	4	27·6
Three to six months	32·8	17	29·3
Six to nine months	18·4	19	25·9
Nine to twelve months	13·6	23	
Twelve to eighteen months	11·2	20	5·2
Above eighteen months	5·6	17	12
Total	100	100	100

It will be seen that while Lebert's figures indicate a comparatively long duration, our own closely agree with those of Osler and McCrae in the main fact that only about 17 per cent. of all cases survive longer than a year. As a rule carcinoma of the stomach in early life runs a much shorter course than in adults, according to Mathieu the mean duration of cases less than thirty years of age being about three months. Colloid

cancer is also relatively frequent in the young, and usually displays a considerable rapidity of development.

Most authorities allude to cases which were supposed to have existed for periods varying from three to ten years (twenty years—Ballou), and it is usually stated that Napoleon the First died from a cancer of the stomach of nine years' duration. But before these statements can be accepted certain sources of error require to be eliminated. It has already been remarked that a neoplasm sometimes attacks a simple ulcer or its scar, the evidences of which it obliterates during the course of its growth. It consequently follows that many patients give a history of pain after food, vomiting, hæmatemesis, and loss of flesh extending over a considerable number of years prior to their death from carcinoma of the stomach. In other instances some functional disorder of the stomach or colon precedes the development of the fatal malady, but owing to the similarity of the symptoms of the two complaints the entire illness is attributed to the final and fatal disease. This seems to be the explanation of the statement concerning Napoleon's illness, for in the numerous histories of his life no evidence is forthcoming of the anorexia, vomiting, progressive loss of flesh, and failure of strength which invariably accompany even the most chronic form of cancer of the stomach; while the occasional references to 'mon pylore' during his attacks of abdominal pain were probably the outcome of the confusion that exists in a non-medical mind between symptoms due to disease of the stomach and those that arise from a disorder of the colon. On the other hand, the increasing tendency to corpulence which marked the last few years of his life, the rapid course pursued by the disease when once it became manifest, and the delirium that preceded death for a fortnight, all point to the presence of a growth of great malignancy, and consequently of short duration.

Although the question of average duration is endowed with a certain amount of interest, it is of little value to the clinician, who has to offer an opinion as to the probable duration of life in each individual case that comes under his notice. It is therefore necessary to consider the relative influence exerted by certain special conditions upon the progress of the complaint. Of these the most important, in our opinion, is the situation of the growth in the stomach. In the following table we have analysed 125 cases in order to show the proportional

death-rate at different periods in carcinoma of various regions of the stomach.

TABLE 29.—SHOWING THE DURATION OF LIFE IN CARCINOMA OF DIFFERENT REGIONS OF THE STOMACH

Duration in months . . .	1-3 months	3-6 months	6-9 months	9-12 months	12-18 months	18-24 months
Cardia (with œsophageal obstruction)	30·7%	38·5%	23·1%	7·7%	—	—
Cardia (œsophagus not affected) .	12·5%	50%	12·5%	25%	—	—
Walls and curvatures . . .	13%	30%	26%	17·4%	8·6%	4%
Pylorus (with stricture) . . .	13·5%	27%	27%	15·4%	11·5%	5·6%
Pylorus (without stricture) . .	14%	28·5%	11·4%	22·8%	14·3%	9%
General infiltration . . .	12·5%	25%	12·5%	—	37·5%	12·5%

It will be observed at once that carcinoma of the cardia is more rapidly fatal than disease of any other part of the organ, and more especially in those cases where the œsophagus is obstructed by the growth. Thus, of the cases in which dysphagia occurred as an early symptom, 92 per cent. died within nine months, while of those where the œsophagus was not involved 75 per cent. succumbed in the same period. In no instance did disease of the cardiac third of the stomach persist for more than a year. This comparatively short duration appears to depend partly upon the abnormal rapidity of growth exhibited by neoplasms in this region, and partly upon the inordinate frequency with which the disease gives rise to dysphagia, inflammation of the left pleura, and secondary growths in the liver and peritoneum.

Next in order of rapid fatality are cases in which the walls and curvatures of the stomach are primarily affected by the neoplasm. Of such, 69 per cent. died within nine months and 86 per cent. within twelve months, while only 4 per cent. survived more than eighteen months. Here again the disease usually exhibited an abnormally rapid growth, and frequently involved the liver and peritoneum.

The duration of life in disease of the pylorus depends to a great extent upon the condition of the orifice. In those cases where there was marked stenosis 67 per cent. died within nine months and 83 per cent. within a year; while of those which presented a patent orifice, or where the obstruction was of secondary importance, only 54 per cent. succumbed within nine months and more than 23 per cent. survived a year.

Contrary, perhaps, to what might have been expected, cases of general infiltration of the stomach often progress comparatively slowly, only 50 per cent. dying within nine months and about the same proportion surviving between one and two years. The fact that in many instances of this kind the symptoms remain slight and ill-defined for a considerable period renders it probable that the average duration of general cancerous infiltration is even longer than that indicated; and from our own experience we should say that, in the absence of pyloric and cardiac obstruction and of secondary growths in the peritoneum, life may sometimes be prolonged for three or even four years.

Early implication of the liver or peritoneum exerts an important influence upon the duration of the disease. Thus, of those cases in our series which died within three months, secondary growths were found in the liver in 60 per cent., but in only 53 per cent. of those who died between the third and sixth months, and in 43 per cent. of those which survived that period. In like manner, the peritoneum was found to be affected in 40 per cent. of those who succumbed within three months, in 24 per cent. of those who died between the third and the sixth months, and only in 18 per cent. of the cases that survived for a longer period.

Prognosis.—The prognosis of cancer of the stomach is always hopeless, for there is no authentic case on record in which the disease was ultimately cured. It is true that at one time the discovery of the partial repair that occasionally occurs in a malignant ulcer gave rise to the idea of a 'spontaneous cure of cancer;' but the hope implied has never been realised, owing to the invariable development of secondary growths.

The course of the disease is always so uncertain that it is extremely difficult to foretell, even approximately, the date of the fatal issue. In our opinion, the disappearance of the sulphocyanide of potassium from the saliva is one of the most important indications of approaching dissolution, for we have never observed life to be prolonged for more than a month after the saliva had become permanently free from the salt. Effusions into the peritoneum and pleuræ are always associated with rapid deterioration of strength, and are rarely compatible with the prolongation of life for more than three months. Rapidly increasing anæmia, the constant presence of altered

blood in the contents of the stomach, diarrhœa, and a steady diminution in the tension of the pulse, all point to an early termination of the disease. The cause of death in our various cases is shown in the following table.

TABLE 30.—SHOWING THE APPARENT CAUSE OF DEATH IN 265 CASES OF CARCINOMA OF THE STOMACH

Cause of death	Cases	Percentage
General exhaustion	191	72
Perforation (acute peritonitis)	6	2·3
Perforation (local abscess)	8	3
Hæmorrhage	2	0·75
Endocarditis (acute and chronic)	8	3
Pneumonia	16	6
Hydrothorax	8	3
Cerebral complications (apoplexy, thrombosis, metastases, coma)	18	7
Intestinal obstruction	6	2·3
Bright's disease	2	0·75
Total	265	100

CHAPTER IX

DIAGNOSIS

THE problem of diagnosis is a threefold one. In the first place, it is necessary to consider the clinical aspect of the disease in its entirety, in order to establish the existence of certain general features, which may serve to distinguish it from other disorders of the digestive organs. In the second, the symptoms and signs which develop at an early period must be separated from those which mark an advanced stage of the complaint, so that a clue may be obtained to the recognition of a cancerous growth before it has progressed too far to admit of complete removal. Thirdly, those abnormal varieties of the complaint which have been previously described require to be differentiated from other diseases to which they bear a general resemblance.

General Diagnosis

In every other gastric disease the symptoms that ensue from the disturbance of digestion are not only the first to attract attention, but continue of primary importance throughout the whole course of the malady. But in cases of carcinoma the secondary or constitutional phenomena always seem out of proportion to the disease in the stomach, and often constitute for some time the sole sources of complaint. In this category loss of flesh, diminution of energy and strength, and progressive anæmia are the most conspicuous, and increase in severity in spite of all efforts at treatment. Another fact which seldom fails to impress itself upon the minds of onlookers is the strange pessimism exhibited by the patient, who will continue to avow that he is growing worse even when his symptoms show signs of remission, or even subside for the

time. Equally rebellious are the strictly local phenomena. If flatulence is the chief cause of complaint, it remains uninfluenced by the administration of those medicinal remedies which usually relieve it, while the pain after food is rarely removed by the most careful attention to diet. In like manner, the substitution of liquids for the solid forms of nourishment often seems to increase rather than to allay the tendency to emesis, and no temptation by favourite dishes can overcome the increasing dislike to meat and other kinds of food. Sooner or later, to these various causes of suspicion there is added a symptom which at once directs attention to the serious nature of the gastric lesion: during an attack of vomiting, or as a result of the employment of a tube, the ejecta are found to contain altered blood, or the patient suffers from a veritable attack of hæmatemesis. Unlike, however, the hæmorrhage from a simple ulcer, the loss of blood does not relieve the previous symptoms, while the anæmia to which it gives rise continues to increase, and is unaffected by the administration of iron.

Examination of the stomach rarely fails to throw some light upon the nature of the disease. Even at a comparatively early period the hydrochloric acid of the gastric secretion is found to be much diminished, and within a short time it can no longer be detected in a free state; while in most cases the disappearance of the free mineral acid is associated with the production of lactic acid and the presence of the Oppler-Boas bacillus. Dilatation of the stomach is almost invariably present when the growth affects the pylorus, and as the organ increases in size the attacks of emesis exhibit a peculiar periodicity of recurrence, while the passage of a tube in the early morning reveals the existence of food-stagnation. Just as hæmorrhage is the most important of the various local symptoms, so the detection of a tumour constitutes the physical sign of the greatest moment. The period at which a tumour develops varies in different cases, but when once a tender growing mass attached to the stomach is discovered, further evidence as to the nature of the disease may be regarded as superfluous. In other cases equally important evidence is derived from the infection of organs outside the stomach. Thus, the liver may enlarge and present several palpable growths in its substance, or small tumours may appear in the skin of the abdomen near the umbilicus, with, perhaps, a cord-like induration of the linea alba. In

other instances, again, the pleuræ or the lungs exhibit signs of disease, ascites or jaundice develops, the glands above the left clavicle become enlarged, or the veins of the legs are affected by thrombosis. Examination of the blood always indicates the existence of secondary anæmia, the slight degree of leucocytosis which normally occurs after meals may be absent, the sulphocyanide of potassium in the saliva tends to disappear, and perhaps small particles of the morbid growth may be detected in the vomit or the washings of the stomach.

Early Diagnosis

In addition to the desirability of recognising a fatal disease as soon as possible, the recent advances which have been made in gastric surgery give ground for the hope that a malignant growth of the stomach might be removed with success if the operation is undertaken before infection of the structures outside the stomach has occurred. The question of 'early diagnosis' has consequently become one of paramount importance, and numerous treatises have been published which purport to aid in its elucidation. Unfortunately, however, it would seem that their authors are more concerned with the early recognition of certain physical signs than of the disease from which they arise. Thus, the majority of writers still centre their attention upon the diagnostic importance of a tumour, and detail with the utmost minuteness the methods in vogue for its detection and differential diagnosis. But we have already endeavoured to show that a palpable tumour is absent in nearly one fifth of all cases of carcinoma of the stomach, and that its existence bears witness to the fact that the growth has given rise either to an extensive infiltration of the gastric wall or to a secondary infection of the great omentum and lymphatic glands. It is obvious, therefore, that while a tumour affords conclusive evidence of the *existence* of carcinoma, it also indicates that the disease has already existed for a considerable period of time and is too far advanced to admit of complete removal. Other authorities consider that the solution of the difficulty is to be found in the altered state of the gastric secretion, and affirm that an absence of free hydrochloric acid and the presence of a large quantity of lactic acid after a test meal are pathognomonic of the complaint. On the other hand, it has

already been shown that not only are one or both these indications absent in about 10 per cent. of all the cases of gastric carcinoma, and that those neoplasms which originate in a simple ulcer usually exhibit an excess of hydrochloric acid, but that other diseases of the stomach are occasionally accompanied by similar changes in the secretion. Moreover, the chronic gastritis which is the immediate cause of the disappearance of the hydrochloric acid is itself only a secondary effect of the morbid growth, and seldom develops until either the pylorus has become contracted or the tumour has undergone superficial ulceration. It consequently follows that these chemical phenomena are at most merely confirmatory of the existence of the disease, and from the point of view of early diagnosis their value is strictly limited.

Nor does it seem that those who rely entirely upon the microscope are either more accurate in their conclusions or better able to recognise the complaint at an exceptionally early period of its development, since the Oppler-Boas bacillus does not appear in the contents of the stomach without the coexistence of lactic acid, while minute particles of growth or cells showing irregular mitoses are rarely, if ever, present in the washings of the organ unless the disease has invaded the mucous membrane. Lastly, it may be observed that some surgeons regard an exploratory laparotomy as the best method of diagnosis, while a few even advocate the operation in every case of dyspepsia that develops after middle age and fails to subside after six weeks of medical treatment. Apart from the inconvenience which the adoption of this suggestion would entail upon several millions of men and women who from various causes become the subjects of troublesome indigestion at this period of life, it has yet to be shown that digital exploration of the stomach is at any time a certain method of diagnosis. All experience goes to show that even after death much difficulty is often experienced in distinguishing a localised carcinoma of the gastric wall from a simple ulcer or its scar; while a careful comparison of the conditions found at the autopsy with the apparent discoveries made at the operation in a large series of cases have convinced us that even the most experienced surgeons are very apt to confound the results of inflammation, of simple ulceration, and even of syphilis, with malignant growths of the stomach and duodenum. It must therefore be conceded that as a rule exploration of the

stomach through an abdominal incision is not a method of diagnosis which can be recommended either for its simplicity or accuracy.

While it must be acknowledged that at the present time we do not possess any certain means of recognising the existence of carcinoma before it has infected the lymphatic glands, it is possible that in the future some chemical product of the morbid growth may be discovered in the secretion of the kidneys or in the saliva which will render the early diagnosis of the disease a matter of ease and certainty.

Differential Diagnosis

(1) **Carcinoma of the Cardia.**—This variety has chiefly to be distinguished from cicatricial stricture and spasm of the cardiac orifice. Of the three, the malignant affection is by far the most common, for, out of every hundred cases of obstruction at the lower end of the œsophagus, about ninety are due to cancer, seven to simple stricture, and three to cardio-spasm. Carcinoma is rather more frequent in men than women, and seldom develops before fifty years of age. Cicatricial contraction is usually the result of corrosive poisoning, and its symptoms supervene gradually after the subsidence of those arising from inflammation of the œsophagus and stomach. Very rarely it results from a simple ulcer. Chronic cardio-spasm is almost entirely confined to men, although a less severe form is sometimes encountered in anæmic and neurotic women. In each dysphagia is the first and most prominent symptom. In carcinoma and cicatricial stenosis this increases in severity, until regurgitation occurs after every attempt to swallow food; but in cardio-spasm it is apt to vary from time to time, and regurgitation is rare. Carcinoma is accompanied by rapid emaciation, cachexia, and sometimes by pain at the chest, and in spite of all treatment terminates fatally within nine months. The fibrous stricture is more amenable to local treatment, and if gastrostomy is performed life may be prolonged for many years; while cardio-spasm progresses very slowly and may persist for a long time without exercising any serious influence upon the general nutrition. In each complaint the second deglutition sound is greatly delayed or entirely abolished, and a tube inserted into the

œsophagus encounters resistance at sixteen to eighteen inches from the incisor teeth. In the organic varieties the stricture gradually becomes impermeable, but in the functional disorder careful manipulation will often effect the passage of the instrument into the stomach. Dilatation of the œsophagus above the stricture may occur in each instance, and a small quantity of undigested food mixed with saliva may be evacuated by the tube. If the stricture is due to a malignant growth, the extract is often fetid, tinged with blood, and may contain minute particles of the morbid growth, but in the non-malignant cases these evidences of ulceration are usually lacking.

If the malignant growth also affects the fundus, a palpable tumour may be detected in the left hypochondrium, which requires to be distinguished from an enlargement of the spleen, a movable kidney, a growth in the tail of the pancreas, and from a tumour of the colon (fig. 45, p. 173).

(1) An enlarged spleen presents a sharp edge, a smooth surface, and a dull note upon percussion. Tenderness is usually absent, and if the organ continues to grow the long axis of the tumour points towards the opposite iliac fossa rather than in the direction of the umbilicus. Gastric symptoms are absent, and leuchæmia may often be detected. (2) A movable kidney can be displaced by pressure to a much greater extent than a cancerous fundus. Its surface is smooth and non-tender, its outlines well defined, and the percussion-note is resonant, owing to interposition of the colon. Gastric symptoms are wanting, and the other kidney may also be loose. (3) In carcinoma of the tail of the pancreas the tumour is fixed, hard, tender, tympanitic on light percussion, and rarely accompanied by special gastric symptoms, unless it happens to compress the cardiac orifice or involve the stomach. (4) A palpable tumour of the colon due to a malignant growth is rare, and usually consists of a fæcal accumulation above the stricture. The mass is consequently somewhat ill-defined in outline, of softish consistence, and may often be indented by pressure with the finger. It is more movable in a lateral direction than a tumour of the fundus, increases very slowly in size, and may completely disappear after a thorough evacuation of the bowels. The symptoms that accompany it are those of chronic intestinal obstruction rather than of malignant disease of the stomach.

TABLE 31.—SHOWING THE PRINCIPAL POINTS OF DISTINCTION BETWEEN THE THREE VARIETIES OF STRICTURE OF THE CARDIAC ORIFICE

Symptoms	Carcinoma	Cicatricial stricture	Cardio-spasm
Onset	Gradual	After corrosive poisoning or symptoms of ulcer	Often sudden
Dysphagia	Progressive, and finally complete	Progressive	Often intermittent
Regurgitation	Constant	Constant	Rare
Loss of flesh	Rapid	Rapid	Slight or slow
Cachexia	Progressive	Some anæmia	Absent
Duration	Six to nine months	Varies	Years
Exploration of œsophagus	Impermeable stricture at cardiac orifice; some dilatation of œsophagus; extract may contain blood or cancer tissue	Stricture; no hæmorrhage	Tube may pass into stomach
Tumour	Occasionally at a late stage	Absent	Absent
Secondary growths	Frequent	Absent	Absent

(2) **Carcinoma of the Pylorus.**—A morbid growth of the pylorus is chiefly attended by the symptoms and signs of dilatation of the stomach, and has therefore to be distinguished from two other conditions which produce stenosis of the outlet, namely, the cicatrisation of a simple ulcer and adhesions between the pylorus and the gall-bladder or liver.

The malignant disease occurs with equal frequency in the two sexes, and seldom appears before the age of forty-five. Cicatricial stenosis affects both sexes, and is most common between thirty and fifty years of age. The pyloric obstruction which results from cholecystitis is far more common in women than in men and develops at a comparatively early age.

The previous history of the patient is always of great importance. In carcinoma the general health is usually excellent until the onset of the disease; in ulcer the symptoms of gastric dilatation are preceded by severe pain after food and often by one or more attacks of hæmatemesis; while in disease of the gall-bladder there is usually a history of severe attacks of pain, accompanied by vomiting and shivering, and sometimes followed by icterus. In each complaint there are vomiting, flatulence, acidity, nausea, loss of appetite, and constipation; but these symptoms develop much more slowly in the simple

than in the malignant complaint, and are attended by less rapid loss of flesh and an absence of cachexia. In addition to these differences of symptomatology there are three physical signs which greatly help to distinguish the malignant from the benign forms of pyloric stenosis.

In about 71 per cent. of the cases of carcinoma of the pylorus a growing tumour can be detected by palpation, being usually tender on pressure and often becoming adherent to the liver or other neighbouring organ (p. 171). Examination of the contents of the stomach usually shows an absence of free hydrochloric acid, with an excess of lactic acid and the presence of the Oppler-Boas bacillus; while the microscope may reveal particles of cancer tissue or epithelial cells which exhibit atypical mitoses (p. 161). At a later stage secondary deposits are frequently found in the liver, peritoneum, or skin of the abdomen.

Pyloric stenosis due to ulcer is accompanied by hyperchlorhydria without either lactic acid or the Oppler-Boas bacillus, and is rarely attended by a palpable tumour; while in cases of adhesions between the pylorus and the gall-bladder free hydrochloric acid may usually be detected in the gastric contents and the organic acid is absent. As a rule these several distinctions, taken in conjunction with the much longer duration of the benign diseases, and their greater amenability to treatment, allow the latter to be readily distinguished from the malignant complaint; but occasionally both a simple ulcer and pyloric adhesions are associated with a palpable tumour, which greatly complicates their diagnosis.

(*a*) It is only in very exceptional cases that an abnormal degree of thickening at the base of an ulcer gives rise to a tumour in the region of the pylorus. In such the mass usually resembles a walnut in size and shape, or takes the form of a hard ridge or plate; but sometimes it is so large as to produce a tumour visible to the naked eye.

Thus, Clarke has recorded the case of a man, forty-five years of age, who had suffered for some time from pain after food and vomiting. The right side of the epigastrium was swollen, and presented a rounded tumour about the size of an orange. After death, which occurred from peritonitis, the pyloric end of the stomach was found to be occupied by a tumour the size of two fists, to which the neighbouring viscera

were adherent. The mass was composed of pale tough fibrous tissue, which surrounded two deep ulcers with ragged walls. Microscopic examination showed that the tumour was composed entirely of inflammatory tissue. Three or four similar cases have come under our own observation, of which the following is a good example.

Case XX. A middle-aged woman was admitted into hospital for cancer of the stomach. She was greatly emaciated and cachectic, and suffered from constant retching and vomiting. The illness was supposed to have lasted for a year, but there was no history of hæmatemesis or melæna. On examination the stomach was found to be greatly dilated, and its peristaltic movements were plainly visible through the thin abdominal walls. Immediately above and to the right of the navel there was a prominent tumour the size of a large egg, which moved with respiration, was dull on percussion, and very tender. These signs, taken in conjunction with the general appearance of the patient, seemed to warrant a diagnosis of carcinoma of the pylorus, but an examination of the vomit showed that it contained an excess of free hydrochloric acid and no lactic acid. The case was consequently diagnosed as one of chronic ulcer with inflammatory thickening. At the necropsy a deep ulcer was found in the posterior wall of the stomach, close to the pylorus, surrounded by great induration of the tissues. No signs of carcinoma could be discovered.

(*b*) All varieties of pyloric stenosis are liable to be associated with the intermittent appearance of a tumour during the peristaltic contraction of the hypertrophied gastric wall. This condition, however, persists for only two or three minutes at a time, can often be seen as well as felt, and completely disappears as soon as the gastric movement ceases.

(*c*) A gall-bladder adherent to the pylorus seldom gives rise to a tumour unless it happens to contain a large calculus. When this is the case a hard non-tender mass may be detected in the right hypochondrium, in the neighbourhood of the ninth costal cartilage, which moves downwards upon inspiration but is incapable of lateral displacement. Distension of the stomach with gas shows that the pylorus is fixed to the under surface of the liver, the edge of which organ may sometimes be felt at the margins of the tumour. Less frequently a gumma or hydatid of the liver is the cause of the gastric adhesion, and the tumour then presents the general features characteristic of these diseases.

TABLE 32.—THE DIFFERENTIAL DIAGNOSIS OF THE PRINCIPAL CONDITIONS WHICH GIVE RISE TO STENOSIS OF THE PYLORUS

Symptoms	Carcinoma	Ulcer	Pyloric adhesions
History	No previous disease	Symptoms of ulcer	Biliary colic or jaundice
Loss of flesh	Progressive and severe	Moderate	Varies
Cachexia	Present	Absent	Absent
Hæmatemesis	Often coffee-grounds	Occasional and severe	Absent
Gastric contents	No free HCl; lactic acid; Oppler-Boas bacillus; perhaps atypical epithelium	Excess of HCl	Free HCl; no lactic acid
Tumour	Usual. Rapid growth; tender; often movable	Very rare	Occasional. Hard; painless; fixed to liver; no increase in size
Metastases	Usual	Absent	Absent
Treatment	No effect	Good effect	Good effect

(3) **Carcinoma of the Body of the Stomach.**—A growth which involves the surfaces or curvatures of the stomach without implication of an orifice is often accompanied by such severe pain, vomiting, and hæmatemesis that its differential diagnosis from simple ulcer may be a matter of considerable difficulty.

It is usually stated that simple gastric ulcer is a disease of early adult life, and carcinoma one of middle or advanced age, and that the former is most frequent in women and the latter in men. If these statements refer solely to the acute variety of gastric ulcer, the distinctions they imply are correct, but if they include the ordinary chronic form of the complaint, they are not only incorrect but actually misleading. We have shown elsewhere that more than one half of the cases of chronic ulcer commence between thirty and fifty years of age, and that the disease is more common at this period in men than in women, while carcinoma is by no means infrequent between thirty and forty, and is equally prevalent in the two sexes. We lay special stress upon these facts, because we have known many serious errors of diagnosis to ensue from an implicit reliance upon the supposititious differences in the age and sex incidence of the two diseases.

The chief points of distinction between chronic ulcer and cancer are as follows: (*a*) In cancer, debility and loss of

flesh usually precede the local phenomena, while in ulcer they rarely appear until a late stage of the disease. (*b*) In the former the pain is less dependent upon food, is more diffuse, and shows a tendency to increase and to become constant. (*c*) Nausea is most frequent in cancer, and retching and vomiting often occur when the stomach is devoid of food. In ulcer, on the other hand, emesis usually takes place at the height of the painful crisis, and is followed by immediate relief. (*d*) Profuse hæmatemesis is rare in the malignant complaint, while the rejection of small quantities of altered blood is frequently observed. In ulcer the hæmorrhage occurs at irregular intervals and is very abundant. (*e*) Anorexia is an early and progressive symptom in carcinoma, and the tongue is often foul, while in ulcer the appetite is usually preserved, although the patient is afraid to indulge it, and the tongue is red and clean. (*f*) Free hydrochloric acid is rarely present in the vomit or the contents of the stomach in cases of carcinoma, while lactic acid may exist in excess. In ulcer the mineral acid is usually increased and the organic acid absent. (*g*) Microscopical examination of the vomit or washings of the stomach in malignant disease may detect the Oppler-Boas bacillus, cancer cell-nests, or epithelial cells showing irregular mitoses. (*h*) Leucocytosis after meals is often absent in cases of cancer, but is always present and may be slightly increased in chronic ulcer. (*i*) A tumour connected with the stomach is the rule in cancer, but the exception in ulcer. (*j*) In carcinoma the sulphocyanide of potassium in the saliva rapidly diminishes and eventually disappears, while in ulcer the salt can be detected until a late stage of the complaint. (*k*) A milk diet often increases the abdominal pain or discomfort of the former complaint, and the patient continues to lose both flesh and strength when restricted to liquids; in the latter, abstention from solid food is followed by the immediate amelioration of the symptoms, and milk almost always agrees well. (*l*) Carcinoma usually gives rise to secondary deposits in the liver, peritoneum, or skin of the abdomen, to enlargement of the glands above the clavicle, or to venous thrombosis, and usually runs its course in less than twelve months. In ulcer the physical signs remain unaltered and the symptoms may persist for many years.

A carcinomatous tumour of the body of the stomach has to be distinguished from that produced by a foreign body in the

viscus, from the pancreas in a normal or diseased state, from a retro-peritoneal cyst, and from a tumour of the colon.

A hair-ball constitutes the variety of foreign body most liable to be mistaken for a growth of the gastric wall. This interesting condition, however, is practically confined to young women, and usually commences before the age of puberty. The mass is hard, superficial, dull on percussion, painless, very movable, and of extremely slow growth. The symptoms which accompany it are those of chronic dyspepsia, and careful inquiry will usually elicit a history of hair-swallowing (see Part II.).

When great emaciation exists and adhesion of the pylorus to the liver has induced a dislocation downwards of the dilated stomach, the uncovered pancreas may sometimes be felt as a hard transversely situated mass just above the umbilicus. The apparent tumour, however, does not move with respiration like a gastric growth, is incapable of displacement by the hand, does not increase in size, is deeply situated in the abdomen, and is found to lie above the lesser curvature of the stomach.

A cyst of the pancreas usually comes forward between the great curvature of the stomach and the transverse colon. Over its exposed portion the percussion-note is dull, while elsewhere the superimposed stomach or bowel gives rise to a resonant note. The outlines of the mass are ill-defined, the general shape is globular, and no movement can be detected upon respiration or pressure. Inflation of the stomach shows that viscus to be in front of or above the tumour, while the symptoms and signs of gastric carcinoma are invariably absent.

In those rare cases where a small cyst forms in the head of the pancreas and compresses the second part of the duodenum, the symptoms of gastric dilatation, combined with the detection of a tumour, may give rise to much difficulty of diagnosis.

Case XXI. A man, sixty-five years of age, was admitted into hospital under our care for hæmatemesis. He stated that about two years previously he had been attacked by severe pain in the stomach and sickness, which had recurred on several occasions but had never been followed by jaundice. Two days before admission he had vomited a large quantity of bright blood after suffering for some time from discomfort and distension after food. On examination the stomach was found to be much dilated, and just above and to the right of the umbilicus a hard, smooth, and fixed tumour could be

felt. At certain times the percussion-note over the swelling was dull, while at others a splashing sound was elicited. Inflation of the stomach and colon neither affected the position of the tumour nor its percussion-note. After ten weeks' treatment he was found to have become very thin, and still suffered from attacks of pain and vomiting. A surgeon was therefore asked to make an attempt to relieve the pressure on the duodenum. At the operation the tumour was found to be situated deeply behind the small intestine, and was so hard and fixed that a diagnosis of carcinoma was given and the wound was closed. Death occurred next day.

FIG. 53.—Drawing of the posterior wall of a stomach, showing a large chronic ulcer, through which the pancreas projects in the form of a tumour. (London Hospital Museum.)

Necropsy. The head of the pancreas was occupied by a cyst the size of a Tangerine orange, which had pressed upon and partially obstructed the duodenum. The cyst contained a quantity of brownish fluid, but no connection between its cavity and the pancreatic duct could be found. No ulcer or cicatrix existed in the stomach or duodenum, and there was no evidence of carcinoma in any organ.

In very rare cases the pancreas projects into the cavity of the stomach through the floor of a large chronic ulcer, and gives rise to a palpable tumour.

Kollmar has recorded the case of a man who died with extreme cachexia, an abdominal tumour, and other signs of cancer of the stomach. At the necropsy the naked-eye appearances of the disease seemed to confirm the diagnosis, but when the tumour was incised it was found to consist of a pot-shaped ulcer of the stomach with greatly thickened edges, through the base of which the head of the pancreas projected. If a tumour of this description can occasionally puzzle the pathologist, it is hardly surprising that the surgeon is not infrequently confused by the condition which he detects upon digital exploration of the stomach. The difficulties that may attend this method of diagnosis are well illustrated by a case cited by Palawski, where an exploratory operation was undertaken on account of continuous pain, vomiting, and hæmatemesis. When the abdomen was opened the stomach was found to be adherent to the neighbouring viscera, and the retro-peritoneal glands were enlarged. The finger was then inserted through an incision in the anterior wall of the stomach, and a large cauliflower growth was detected upon its posterior surface. Carcinoma was accordingly diagnosed and the wound closed; but at the necropsy the supposititious growth was found to consist of the pancreas, which projected through the base of a simple chronic ulcer.

Cysts of the lesser cavity of the peritoneum or of the posterior wall of the stomach are very rare. They are freely movable, painless, smooth, of very slow growth, and the pain and vomiting to which they occasionally give rise are dependent upon stretching of the pyloric end of the viscus or of the duodenum over the surface of the sac (Part II., Chap. VI.).

Much more difficult is the diagnosis of a malignant tumour of the great curvature from a fæcal mass in the colon. Not only are the two organs in close proximity, but a functional disturbance of the one is always accompanied by a disorder of the other; while in the majority of the cases the neoplasm of the stomach contracts adhesions with or actually extends into the bowel. In both conditions the tumour is placed transversely in the abdomen, is irregular in outline, tender, freely movable, and comparatively dull on percussion. It consequently happens that carcinoma of the great curvature is frequently mistaken for a fæcal accumulation in the colon, and *vice versa*. As a rule, however, pain, vomiting, and emaciation are much less

marked in a case of fæcal tumour than in the gastric disease, while the stomach during digestion presents a normal secretion of hydrochloric acid. The colonic tumour is seldom attended by spontaneous pain, is of slower growth, and steady pressure with the finger may produce pitting of its substance. In most cases also the tumour is diminished or removed by the continued use of aperients and large enemata.

TABLE 33.—THE DIFFERENTIAL DIAGNOSIS OF CARCINOMA AND CHRONIC ULCER OF THE STOMACH

Symptoms	Carcinoma	Ulcer
Pain	Constant, dull or lancinating; increased by food and pressure	Severe, paroxysmal; increased by solid food, relieved by milk diet
Vomiting	Frequent; retching and nausea; affords little relief to pain	Occasional; during painful crisis; relieves pain
Hæmatemesis	Frequent; small quantities of coffee-ground vomit	Occasional and profuse
Appetite	Diminished or absent	Good, unless vomiting severe
Colour	Progressive cachexia	Anæmia proportionate to loss of blood
Loss of flesh	Rapid and continuous	Gradual
Gastric contents	Much mucus; no free HCl; lactic acid present; Oppler-Boas bacillus; perhaps characteristic cells	Rapid digestion; free HCl, perhaps in excess; no lactic acid
Saliva	Gradual disappearance of sulphocyanide of potassium	Sulphocyanide normal
Physical signs	Tumour connected with stomach, painful, increasing in size; thrombosis of veins; secondary deposits	Tender spot in epigastrium; tumour very rare

(4) The Anæmic Form.—Carcinoma of the stomach, when accompanied during its early stages by intense anæmia, may be readily confused with pernicious anæmia, and sometimes even with leucocythæmia.

From the former it is chiefly distinguished by the prominence of certain constitutional symptoms and the lesser importance of its blood changes. Loss of flesh and strength accompanies the malignant complaint from the outset, and the temperature of the body is rarely elevated more than one or two degrees at night. In pernicious anæmia the patient often grows fat, dyspnœa and palpitation are experienced upon exertion, and periodic attacks of fever are the rule. In both there may be excessive thirst and want of appetite, with

flatulence and discomfort after meals and occasional vomiting; but in carcinoma these symptoms steadily progress, while in pernicious anæmia a temporary improvement in the quality of the blood is accompanied by a corresponding amelioration of the dyspepsia and a return of the appetite. The administration of iron and arsenic in the gastric disease greatly increases the symptoms of dyspepsia, without producing any beneficial effect on the condition of the blood. Exploration of the stomach with a tube during the period of digestion will often reveal the presence of altered blood in carcinoma, while the gastric contents exhibit an excess of lactic acid, but no free hydrochloric acid. In pernicious anæmia the mineral acid is also apt to fail, but lactic acid fermentation is rare and hæmorrhage never occurs. The blood in gastric cancer shows a marked deficiency of red corpuscles, but their number rarely falls below one and a half million per cubic millimetre; poikilocytosis is rare, and megaloblasts are never encountered. After a few months a tumour can usually be discovered in connection with the stomach, or secondary deposits are detected.

Leuchæmia with a palpable enlargement of the spleen is very rare in carcinoma of the stomach, but when it exists the absolute exclusion of leucocythæmia is practically impossible. In most of the cases, however, the malignant disease shows itself by the development of a gastric tumour and dilatation of the stomach, or by the presence of gastric symptoms associated with a failure in the secretion of hydrochloric acid.

(5) **The Ascitic Form.**—In this variety the early development of ascites, with the frequent absence of gastric symptoms, renders the disease liable to be mistaken for tubercular peritonitis or cirrhosis of the liver.

Carcinoma of the peritoneum may occur either in the form of numerous discrete growths of considerable size or as a miliary affection of the serous membrane. In the former case examination of the abdomen reveals the existence of several tumours, whose tenderness and rapidity of growth are suggestive of their malignant nature, while in the latter no tumour can be detected either by palpation or digital exploration of the rectum. In both instances the effusion may be unaccompanied by pain or vomiting for two or three months, and the principal symptoms consist of distension after meals with excessive flatulence. Careful examination, however, will usually show

that the constitutional symptoms are more pronounced than in other forms of ascites. The soft parts undergo rapid wasting, the lips and conjunctivæ are markedly anæmic, and although the temperature is subnormal, the patient usually expresses an aversion to food. The skin is loose and dry, the secretion of urine is diminished, and œdema of the legs and thrombosis of the saphenous or femoral veins frequently occur. After a variable interval attacks of abdominal pain are apt to supervene and to prove severe, while in most cases nausea, vomiting, and hæmatemesis are observed. The physical signs vary according to the size of the peritoneal growths. When these are comparatively few in number, and principally affect the great omentum or the more superficial portions of the serous membrane, one or more discrete tumours may be detected on palpation, which rapidly increase in size, are tender on pressure, dull on percussion, and, though movable with respiration, gradually become fixed by adhesions to the neighbouring coils of bowel. Digital exploration of the pelvis will also detect one or more nodular growths in the pouch of Douglas or in the wall of the vagina or bowel, which are apt to press upon the bladder and to cause frequent and difficult micturition. Subsequently small metastases develop in the neighbourhood of the umbilicus, or infiltration of the linea alba occurs. In miliary carcinoma of the peritoneum the growths are too small to form palpable tumours, and the most important indications of the disease arise from the contraction of the mesentery and transverse mesocolon with which it is usually accompanied. In such the percussion-note over the front of the abdomen is uniformly dull instead of being resonant, while posteriorly the note over the lumbar region is much clearer on one side than on the other, owing to the adhesion of the mass of retracted intestine to the back of the abdominal cavity.

Examination of the fluid withdrawn by a syringe will often materially aid the diagnosis. In simple ascites the quantity of albumin is usually less than 2½ per cent., while in cancerous peritonitis it amounts to 3–4 per cent., and is often as high as 5–6 per cent. When the growths are soft and numerous the fluid is often stained with blood, while in certain cases obstruction of the thoracic duct or lacteals gives rise to chylous ascites. When the sediment is examined by the microscope, groups of cancer cells may sometimes be detected, and even the existence

of colloid carcinoma may be recognised by the characteristic changes in the cells. More frequently only a few epithelial cells are obtained by the use of the centrifuge, which exhibit budding or irregular forms of mitosis. Lastly, it is often observed that at the seat of puncture a small hard tumour develops from invasion of the subperitoneal tissue by carcinoma. Tubercular peritonitis in the adult is usually associated with fever. Pain is often a notable feature of the complaint in its early stages, and diarrhœa is apt to alternate with constipation. Loss of flesh and strength is less rapid than in carcinoma; profuse perspirations occur at night, and rigors are not infrequent. The tumour is usually situated across the epigastrium, is nodular, comparatively dull on percussion, rarely very tender, and of slow growth. Tumours are rarely detected in the pouch of Douglas or in the tissues of the rectum or vagina, and in most instances signs of secondary inflammation of the pleura or lung manifest themselves after a few weeks. Ascites from cirrhosis of the liver is usually preceded by symptoms of chronic gastritis, and is accompanied by hæmorrhoids. Abdominal pain is absent, there are no peritoneal tumours, and the floating intestines produce a resonant note on percussion over the

TABLE 34.—THE DIFFERENTIAL DIAGNOSIS OF THE PRINCIPAL DISEASES ACCOMPANIED BY EARLY ASCITES

Symptoms	Carcinoma of peritoneum	Tubercle of peritoneum	Cirrhosis of liver
Previous history	Sometimes pain after food or vomiting	Occasionally phthisis	Abuse of alcohol; gastritis
Onset	Often rapid	Gradual	Gradual
Pain and vomiting	In later stages	Often at commencement	Pain absent
Loss of flesh	Rapid	Gradual	Slight
Cachexia	Marked	Anæmia	Absent
Appetite	Diminished or absent	Fair	Fair
Temperature	Subnormal	Elevated	Normal
Hæmorrhoids	Absent	Absent	Usually present
Tumour	Frequent; multiple; rapid growth; affects pelvis	Epigastric; nodular; slow growth	Large liver
Abdomen	Often dull on percussion in front, resonant in loin	Signs of free fluid	Signs of free fluid
Fluid	Very albuminous; perhaps blood or chyle; cancer cells	Cloudy; perhaps tubercle bacilli	Clear
Metastases	Abdominal wall, linea alba, pleuræ	Tubercular disease of intestines or lungs	Absent
Duration	Three to six months	Varies	Years

umbilical region. The liver is found to be enlarged and hard, and a history of over-indulgence in alcohol can usually be obtained.

(6) The Dyspeptic Form.—When a malignant growth of the stomach is merely accompanied by symptoms of indigestion, and for several months presents no indications of a tumour or of gastric dilatation, it is very apt to be confused with chronic gastritis or nervous dyspepsia.

Chronic gastritis may occur at any age and in either sex. In the great majority of cases there is a history of abuse of alcohol, or there are signs of disease in the lungs, heart, liver, or kidneys. Pain after food is rare, but the patient experiences fulness and discomfort during the period of digestion, accompanied by flatulence, acid eructations, and nausea. Vomiting may occur after meals, but it is also frequent in the early morning before breakfast, when an attack of retching causes the rejection of ropy mucus. The appetite is diminished but not lost, there is much thirst, and the tongue is usually large, pale, furred, and indented by the teeth. Constipation is apt to alternate with diarrhœa, and the urine is loaded with urates.

TABLE 35.—SHOWING THE CHIEF POINTS OF DISTINCTION BETWEEN CARCINOMA, CHRONIC GASTRITIS, AND NERVOUS DYSPEPSIA

Symptoms	Carcinoma	Chronic gastritis	Nervous dyspepsia
Onset	Gradual	Preceded by alcoholism, phthisis, or kidney disease	Often sudden
Pain	Varies; usually increased by food	Rarely severe; discomfort or oppression	Paroxysmal; often very severe
Vomiting	Usually after meals or in early morning	After meals or in early morning	Often absent
Hæmatemesis	Frequent; in small quantity	Rare	Absent
Appetite	Diminished or absent	Diminished	Varies
Bowels	Constipation	Occasional attacks of diarrhœa	Often lienteric diarrhœa
Loss of flesh	Progressive and severe	Slight	Varies with appetite
Colour	Progressive cachexia	Sallow	Moderate anæmia
Gastric contents	No free HCl; lactic acid	Diminished HCl; no lactic acid	HCl often excessive
Physical signs	Dilatation of stomach or tumour in later stage; secondary deposits; thromboses	Some gastrectasis; no tumour; piles; ascites in late stage	Often absent
Treatment	No avail	Symptoms abate	Varies

Unless cirrhosis of the liver is present, hæmatemesis never occurs. Some degree of gastrectasis may be detected, but there is no tumour, and the gastric contents are usually devoid of lactic acid. The symptoms subside to a great extent under treatment.

The term 'nervous dyspepsia' includes a large number of disorders arising from a functional disturbance of the stomach or bowel. In every case, however, the constitutional symptoms of carcinoma are lacking: pain, when it exists, displays paroxysmal characters; vomiting is infrequent, there is no abdominal tumour, and free hydrochloric acid may usually be detected in the contents of the stomach.

CHAPTER X

TREATMENT

General Measures.—The well-known fatality and popular dread of cancer render it advisable that very guarded terms should be employed in the designation of the complaint until the diagnosis can be made with certainty. This is the more important as the mental depression which invariably accompanies it is often replaced by actual melancholia when the patient realises the true nature of his malady, and not only is the duration of life curtailed by his refusal to partake of food or to undergo the usual palliative treatment, but it may be cut prematurely short by suicide. We have known several instances in which the patient destroyed himself a few days after being informed that he was suffering from cancer of the stomach. So far as may be consistent with insuring his appreciation of the serious nature of his disease, it is therefore wise to avoid the use of such popular terms as 'cancer,' 'growth,' or 'malignant disease.'

During the early stages of the complaint the patient should be encouraged to perform his usual avocations, and when this becomes impossible it is better that he should dress and recline upon a couch than remain in bed. Change of air is seldom advisable, since any slight benefit that might accrue from a bracing atmosphere hardly compensates for the loss of home comforts entailed by residence in an hotel or lodging-house. When the stomach is much dilated, vomiting is often relieved and the sense of weight and fulness diminished by the application of a firm bandage to the abdomen in such a manner as to afford support to the enlarged viscus. Massage and electricity are of no value when gastrectasis arises from a growth of the pylorus, and the recourse to these and other so-called 'cures' is inevitably followed by much disappointment and financial loss. It is possible, however, that further

experience may show that the Röntgen rays exercise a beneficial effect. The severe pain in the abdomen which ensues from perigastritis or the development of metastases in the liver and peritoneum may often be relieved by stimulant or sedative applications to the skin. In chronic cases the repeated use of small blisters to the epigastrium, followed by dusting of the raw surfaces with a powder composed of acetate of morphine (gr. $\frac{1}{2}$) and hydrochlorate of cocain (gr. $\frac{1}{4}$), is of the greatest value; but in the more acute conditions hot fomentations or poultices, with a liniment of belladonna or tincture of opium sprinkled upon them, are more beneficial.

Lavage may be employed with advantage in the majority of cases, but it is chiefly indicated when obstruction of the pylorus has given rise to dilatation of the stomach. The benefit derived from its use is of a threefold kind. In the first place, stagnation and decomposition of the food are controlled, the tendency to secondary gastritis is diminished, and the progress of the dilatation retarded. Secondly, the systematic cleansing of the surface of the stomach from the thick mucus which adheres to it tends to promote secretion and to aid absorption of the food. Thirdly, the periodic removal of the products of fermentation relieves such symptoms as acidity and vomiting, and often stimulates the appetite to a remarkable degree.

In order to obtain the best results lavage should be commenced as soon as possible and performed in a regular and efficient manner. Opinions differ as to the period of the day when it should be employed, and it is probable that each case requires to be considered upon its own merits. In most instances the stomach is most conveniently washed out just before the patient retires to bed or about three hours after his last meal, as by this means the retention of food during the night is obviated and the insomnia which so often arises from nocturnal indigestion is prevented. As the disease progresses a single lavage is seldom sufficient, and it is advisable that the patient be taught to empty and cleanse his stomach both morning and evening. For this purpose warm water containing bicarbonate of sodium (2–5 grains to the ounce) is usually all that is required; but if an antiseptic is considered necessary, boracic acid (2 per cent.), salicylic acid (3 per cent.), benzoate of sodium (2 per cent.), resorcine (3 per cent.), thymol (0·5 per

cent.), or lysol (0·1 per cent.) may be employed. It is important to empty the stomach completely at the termination of the operation, since the retention of any of these solutions may give rise to serious toxic symptoms. A soft tube is also of value as a means of introducing food into the stomach in cases of carcinoma of the cardiac orifice. The subjects of this complaint should not be permitted to exist solely upon what they can manage to swallow, but from the onset of the dysphagia their nutrition should be maintained by forcible feeding or nutrient enemata. The tube should be soft and of moderate calibre, and be introduced with the greatest caution. As soon as it has entered the stomach a pint and a half of peptonised milk, egg and milk, clear soup, or other form of liquid nourishment is poured in through a funnel and the instrument withdrawn. This procedure must be repeated every six or eight hours, and as the stricture becomes more pronounced the size of the tube should be reduced.

The chief contra-indication to the employment of a tube for lavage or feeding is the existence of hæmorrhage. When the vomit constantly contains altered blood, or attacks of hæmatemesis occur at short intervals, the growth is invariably ulcerated and often extensive. In such cases the careless employment of an instrument may produce serious results, and we have more than once seen profuse and dangerous bleeding ensue after its use.

Rectal feeding is of great value when gastric intolerance is an important feature of the complaint, and in cases where it is necessary to increase the nutrition with a view to the performance of gastrostomy or gastro-enterostomy. The old-fashioned method of administering two ounces of milk every two hours should be abandoned in favour of much larger injections at greater intervals of time. By the adoption of this procedure the patient is spared a great deal of pain and inconvenience and the tendency to irritation of the bowel is greatly reduced. In every case the rectum should be irrigated with normal saline solution each morning, and the enemata be administered through a large soft tube, which is inserted as far as possible into the bowel. During the operation the patient reclines upon his left side, with his buttocks raised upon a pillow, and the reservoir containing the nutrient liquid which is attached to the tube is suspended about three feet above the level of the couch.

Atmospheric pressure being the only force used in the administration of the enema, the operation requires three-quarters of an hour for its due performance; and if this time is always allowed the whole quantity is absorbed without the least discomfort. As a rule peptonised milk is the best form of nourishment, and fifteen to twenty fluid ounces may be given in the manner described every six or eight hours. The use of peptone and of the various meat essences is not attended by any special benefit, nor is an emulsion of meat and pancreas either more convenient or useful than milk. The majority of the so-called nutrient suppositories merely act as foreign bodies in the rectum, and are either expelled or discovered unaltered in the bowel after death. If a diffusible stimulant is required, a tablespoonful of brandy or whisky may be added to each enema. Eggs are apt to create an unpleasant odour of sulphuretted hydrogen in the sick-room.

Diet.—Both the appetite and the powers of digestion vary so much in different cases that it is usually best to favour, as far as possible, the patient's natural inclinations, and to abstain from hard and fast rules concerning the diet.

The existence of severe pain after meals is frequently the sign of ulceration of the growth, and should be treated upon the same lines as in simple chronic ulcer. If raw milk agrees, from five to eight ounces may be given every two hours, but when it gives rise to nausea or discomfort it should be peptonised, sterilised, or mixed with an equal quantity of lime-water. Clear soups, the Leube-Rosenthal beef solution, or the various meat essences, jellies, or extracts may be tried, and the diet may be varied with eggs beaten up with milk, poached eggs, soft bread and butter, bread and milk, or milk puddings. In less severe cases scraped raw meat, boiled chicken, and fish that has been passed through a sieve, sweetbreads, and calf's feet or brains may be allowed. Green vegetables are to be avoided, and in most cases raw and stewed fruits occasion pain or acidity.

Stenosis of the pylorus accompanied by excessive vomiting must be treated with a dry form of diet, as free as possible from farinaceous substances. Only the strongest and most concentrated forms of meat essences or solutions should be allowed, and lightly cooked and finely minced meats, fish, and eggs should constitute the staple food. Tea and coffee rarely agree, but

cocoa made from the nibs is often useful. Wines and malt liquors are apt to produce acidity and vomiting, but a small quantity of good brandy or whisky with the meals often aids digestion and prevents the fulness and distension of which complaint is so frequently made. When thirst is a prominent symptom the patient should be directed to sip hot water, or an enema of hot water may be administered from time to time. In all cases nutrition should be aided by the administration of a large enema of peptonised milk each night.

At a late period of the complaint it is usually necessary to peptonise the greater part of the food, and to administer it in small quantities at short intervals.

Medicinal Treatment.—The search for a specific remedy has produced a long list of drugs, each of which at one time or another has been supposed to exercise a controlling influence upon the course of the disease; but from the hard soap advocated by Van Swieten to the infusion of violets of the present day, one and all have failed to check the progress of the morbid growth. It is therefore necessary to direct medicinal treatment to the relief of the various symptoms as they arise.

Anorexia.—This is chiefly to be combated by frequent changes of diet and by the use of lavage. In the early stages of the complaint the various bitters are occasionally of value; but they seldom agree for long, and their injudicious administration is apt to aggravate the tendency to gastritis. Condurango is a favourite remedy with many practitioners, on account of its stomachic properties, and is best prepared according to the directions of Friedreich. Half an ounce of the bark is macerated for twelve hours with twelve ounces of water, after which the fluid is reduced by boiling to half its bulk and strained. One tablespoonful of this solution combined with syrup of orange is given three times a day between the meals. Others prefer the infusions of gentian, calumba, quassia, or chiretta, with or without the addition of nux vomica, while in some cases the cautious administration of arsenic seems to improve both the appetite and the general condition. The fact that most cases of carcinoma of the stomach are attended by a diminished secretion of hydrochloric acid naturally suggests the administration of this drug as an aid to digestion. It is chiefly of use when the growth affects the cardiac or central region of the stomach; but in pyloric stenosis it often appears

to increase the pain and vomiting, owing to its irritant influence upon the inflamed gastric mucosa. Occasionally the use of pepsin, lactopeptine, or papain seems to increase the powers of digestion. Chlorate of sodium in doses of sixty grains three times a day was recommended by Huchard, and is sometimes of value.

Pain.—When this symptom continues severe in spite of careful dieting and lavage, recourse must be had to sedatives. If it chiefly occurs after meals, a mixture containing carbonate of bismuth, bicarbonate of sodium, and dilute hydrocyanic acid will often diminish its intensity, or a pill composed of belladonna, conium, and stramonium may be given immediately after food. Cocain is sometimes of use when the growth is situated near the cardia. At a later period opium is almost always required. Codeine, nepenthe, and the compound tincture of chloroform and morphine are less apt to disturb the digestion than other preparations; but when vomiting prevents the administration of drugs by the mouth, hypodermic injections of morphine and atropine are invaluable. This method is also the best fitted to procure sleep.

Vomiting.—The treatment of this symptom varies with its cause. When, as is usually the case, it arises from obstruction of the pylorus, the daily employment of lavage combined with a dry form of diet is at once the most appropriate and successful mode of treatment. In all cases the administration of antiseptics in an alkaline solution is valuable in preventing excessive fermentation of the food. For this purpose carbolic acid is the most useful, and may be given either in the form of the glycerine preparation (8–12 min.) or the pill. Occasionally full doses of resorcine, hyposulphite or sulphocarbolate of sodium, creasote, or a minim of the tincture of iodine every hour, also afford relief. During an attack of acute gastritis the irritability of the stomach prevents the administration both of food and medicine, and under these circumstances the patient should be confined to bed and cold compresses be applied to the epigastrium, while the nutrition is maintained by rectal feeding. If retching is an urgent feature of the case, a third of a grain of calomel may be placed upon the tongue every three hours, and a sixth of a grain of acetate of morphine may be given by hypodermic injection once or twice a day. The emesis which occurs soon after

food, and is preceded by violent pain, is best controlled by morphine or nepenthe before meals and the repeated application of a small blister to the epigastrium. Chloroform, hyoscyamus, cocaine, and glycerine have also been recommended for this purpose, but their effects are variable and usually disappointing. The regurgitation of food that arises from a stricture of the cardiac orifice must be treated by gavage and rectal feeding. The distressing nausea which is sometimes a prominent feature of disease of the body of the stomach may often be relieved by the use of a mixture containing soda, hydrocyanic acid, and bromide of potassium, taken half an hour before a meal.

Acidity.—Acid eructations depend upon abnormal fermentation of the food, and usually subside as soon as the stomach is washed out night and morning. When this is impossible, bicarbonate of sodium with calcined magnesia may be prescribed with an antiseptic, or a bismuth lozenge may be swallowed occasionally. Sometimes charcoal biscuits, or powdered charcoal and iodoform enclosed in a cachet, serve to alleviate this troublesome symptom.

Hæmatemesis.—Severe hæmorrhage is rare, and when it occurs must be treated like that arising from simple ulcer. The patient is confined to bed and fed exclusively by the bowel, while an icebag is applied to the epigastrium in order to control the movements of the stomach. If necessary a small dose of morphine may be given by hypodermic injection. The frequent small losses of blood that arise from general oozing from the surface of the growth require to be arrested, on account of the profound anæmia which they occasion. For this purpose ergot, hamamelis, gallic acid, perchloride of iron, alum, or calcium chloride is usually recommended, but acetate of lead combined with extract of opium, in the form of a pill, is usually more efficacious. The recent introduction of the suprarenal gland has provided an admirable hæmostatic for this and other forms of hæmatemesis, and excellent results follow the administration of the dried and powdered substance, in doses of five grains, every four hours, or of a decoction of a similar strength.

Bowels.—In every case the tendency to constipation requires to be corrected in the early stages of the complaint. One or two teaspoonfuls of the phosphate or tartrate of sodium dissolved in warm water may be given each morning before

breakfast, either by the mouth or through the tube after lavage, or one of the natural aperient waters may be prescribed. With the progress of inanition salines are apt to induce exhaustion, and should be omitted in favour of the liquid extract of cascara, the syrup or compound infusion of senna, or a mild pill containing podophyllin and rhubarb. Occasionally the daily use of a glycerine injection or suppository is sufficient. Mercury and drastic purgatives should always be avoided.

Surgical Treatment.—(1) *Carcinoma of the Pylorus.*—The surgical treatment of cancer of the stomach appears in a somewhat different light according as it is viewed from a surgical or a medical standpoint. To the surgeon the chief question is, what operation is likely to be attended by the best results or is the least dangerous under the circumstances. But to the medical attendant the subject is a much more complicated one. In the first place, while confronted by the fact that if left alone the disease will inevitably prove fatal, he is unable to assure his patient that an operation is devoid of grave risk or that a cure will result from it. Again, he has to bear in mind that the responsibility of recommending surgical interference, as well as the results that may be expected to accrue from it, depends almost entirely upon the accuracy of his diagnosis; and on the one hand, if he waits until the nature of the disease can be determined beyond dispute, all hope of cure by the knife will have disappeared, while on the other, if he maintains that it exists in the absence of a tumour, it is possible that a serious operation may be undertaken without adequate cause. Lastly, he has to consider the financial and domestic concerns of his patient, and to determine whether the prospect of a prolongation of life or the relief which may be afforded to the symptoms is likely to compensate for the extra danger and expense incurred. We believe that much trouble and disappointment would be saved to both parties if the facts were always explained in a clear and straightforward manner to the patient and his friends, to whom the decision for or against operation could be safely left.

At the present time opinions seem to be divided as to the best method of dealing with a carcinoma of the pylorus, some surgeons advocating an attempt to excise the growth whenever it appears to be feasible, while others prefer merely to relieve the symptoms by the performance of gastro-enterostomy. Our own investigations lead us to believe that, unless undertaken

within the first two months, an excision will seldom be attended by a complete cure, owing to the rapid infection of the gastric and retro-peritoneal glands that occurs in the majority of cases. In this connection it may be observed that a localised scirrhus which has undergone colloid degeneration appears to be the most favourable subject for operation, while a medullary growth is the most rapidly infective, and therefore the least susceptible of ablation. Unfortunately, statistics are of little value as a guide either to the mortality of pylorectomy or to its ultimate results, since the method of collecting cases from a number of different sources admits of no distinction being made as to the age of the patient, his general condition, the stage of the disease, or the relative skill and experience of the operator. In the series tabulated by Haberkant the death-rate from pylorectomy was 56·7 per cent., and in that by Wölfler 31·2 per cent.; while the figures of Carle and Fantino show a mortality of only 20 per cent. The same difficulties present themselves with regard to the results of gastro-enterostomy; for while hospital records indicate a mortality of 36–43·5 per cent., experience in private practice seems to show that when the operation is performed at an early stage of the disease the risk to life is not greater than in cases of benign stenosis of the pylorus.

Although there can be little doubt that even in the hands of the most experienced surgeons pylorectomy is a more serious operation than gastro-enterostomy, it is also certain that the expectation of life is greater after a successful excision than after the merely palliative measure. With the exception of one doubtful case (Hahn), we have been unable to find a single instance in which life was prolonged for more than two years after gastro-enterostomy for carcinoma. On the other hand, in 1896 Wölfler was able to collect fourteen cases of pylorectomy which had lived for more than two years, and four which had survived for five years; and since that date at least fifteen others have been recorded where life has been prolonged for three years or more.

Contra-indications to Pylorectomy.—If the patient is desirous of a radical operation, two factors require consideration before it can be recommended—his general health and the physical signs of the disease.

The general state of health is best gauged by the severity of certain symptoms.

Prolonged vomiting is always attended by atrophy of the heart, which is indicated by a slow small pulse of extremely low tension. Cases which exhibit this peculiarity are liable to die from heart failure at any time, and rarely survive an operation more than forty-eight hours. The nutrition may be estimated by observing the quantity of *sulphocyanide of potassium* present in the saliva. A marked diminution of the salt is a sign of great enfeeblement of the powers of digestion and absorption, while its absence invariably indicates the near approach of death. Any operation undertaken under these circumstances will prove unsuccessful. *Excessive cachexia* usually arises from ulceration of the growth, and indicates continued loss of blood and an extensive infection of the lymphatic system. Patients who present this symptom, even though they appear well nourished, are usually beyond the hope of cure.

The chief physical signs which contra-indicate an attempt at pylorectomy are the presence of a palpable tumour, adhesions between the pylorus and the liver, and the existence of metastatic deposits.

A palpable tumour proves that the disease is already far advanced and is accompanied by a diffuse infection. Moreover, its *apparent* size is usually less than one half of its real dimensions, and affords no clue to the extent of the surrounding infiltration of the gastric tissues. Adhesion of the tumour to the liver is indicated by its excessive mobility with respiration, its resistance to efforts at lateral displacement, and by the impossibility of fixing the mass at the lowest point of its excursion by pressure of the hand. Even when a tumour cannot be felt, inflation of the stomach will usually show that the pylorus has not been displaced downwards by the increased weight of the organ, but remains persistently at its normal level. The principal signs of metastases are to be found in the liver, peritoneum, lymphatic glands, and skin. As a rule, an increase in the area of hepatic dulness at the back of the right chest can be determined before the edge of the liver becomes palpable. The detection of secondary tumours in its substance marks a very advanced stage of its infection, while the occurrence of jaundice points to direct pressure upon the hepatic or common bile-duct. Peritoneal carcinosis shows itself either by the presence of a tumour in the omentum or in the pouch of Douglas, or by the rapid development of ascites. Enlarge-

ment of the lymphatic glands above the left clavicle, in the left axilla, or in the right groin, indicates involvement of the thoracic duct, of the mediastina or the mesentery; while retraction of the navel, a cord-like band in the linea alba, or nodules in the skin of the abdomen, are signs of an equally wide diffusion of the morbid growth.

Indications for Gastro-enterostomy.—The production of an artificial communication between the stomach and the small intestine serves to allay the excessive vomiting that ensues from obstruction of the pylorus, and in many cases relieves the pain and also retards the progress of the growth. If, therefore, the vomiting cannot be controlled by medical treatment, and threatens to curtail existence by the exhaustion it induces, the operation may be recommended as a palliative measure. To be accomplished successfully it should be performed as early as possible; and, in those cases which only come under observation in an advanced state of exhaustion, it is advisable to have recourse to rectal feeding for several days before the operation is attempted.

(2) *Carcinoma of the Cardia.*—When the morbid growth occupies the cardiac end of the stomach, its removal is impossible, and an obstruction to the entry of food into the organ is the main indication for surgical interference. In all cases, as soon as the diagnosis of stricture of the lower end of the œsophagus can be made gastrostomy should be performed.

(3) *Carcinoma of the Body of the Stomach (Walls and Curvatures.*—In these cases the disease has already made such considerable progress before an accurate diagnosis can be made that any attempt to excise the growth is practically foredoomed to failure. Removal of the entire stomach was performed by Schlatter in 1897, life being prolonged for fourteen months, and has since been successfully done by Brigham, MacDonald, and Richardson; but the operation is such a formidable one that more extended experience is required before any opinion as to its value can be expressed. In certain cases the excessive pain and vomiting arising from a mural growth can be relieved by gastro-enterostomy; but as a rule the results are not more favourable than those achieved by medicinal treatment, while the frequency with which unexpected difficulties are encountered in its performance does not help to commend the operation.

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PART II

TUMOURS OF THE STOMACH AND DUODENUM

CHAPTER I

SARCOMA OF THE STOMACH

ALTHOUGH the occurrence of gastric sarcoma was observed more than thirty years ago, it has only recently been recognised that it constitutes an important, and by no means an infrequent, variety of malignant disease of the stomach. This opinion is founded partly upon the discovery that many specimens which are described in museum catalogues as carcinomatous or fibroid tumours present the characteristic features of sarcoma when examined by the microscope, and partly upon the large number of cases of sarcoma of the stomach that have been published since special attention has been directed to the subject. Thus, Perry and Shaw found four instances of this morbid condition among fifty specimens of malignant disease of the stomach, while in the course of twenty-three consecutive autopsies upon persons who had died from primary neoplasms of the organ we observed two examples of round-cell sarcoma. It may also be noted that whereas in 1897 Schlesinger was able to collect only thirty cases of the disease, in November 1900 the number of recorded instances exceeded sixty, of which fifty-three at least may be regarded as genuine. Although it is impossible to make any absolute statement as to the relative frequency of the complaint, it is probable that the sarcomata constitute from 5 to 8 per cent. of all primary neoplasms of the stomach. Six varieties have been described up to the present time, namely, round-celled sarcoma, spindle-celled sarcoma, fibro-sarcoma, myo-sarcoma, myxo-sarcoma, and angio-sarcoma. Of these the spindle-celled and the

fibro-sarcomata are probably identical, while the single example of myxo-sarcoma appears to have been originally a case of the round-celled type, which had undergone degeneration.

(1) **Round-celled Sarcoma.**—This variety is the one most usually met with, and was observed in thirty-three out of fifty-three cases, or in about 62 per cent. of the entire number. As a rule, it occurs in the form of a dense infiltration of the pyloric third of the stomach, which transforms the coats of this portion of the viscus into a homogeneous yellowish-white mass of rigid consistence and considerable thickness. The peritoneal aspect is often covered with lymph, while the inner surface is slightly

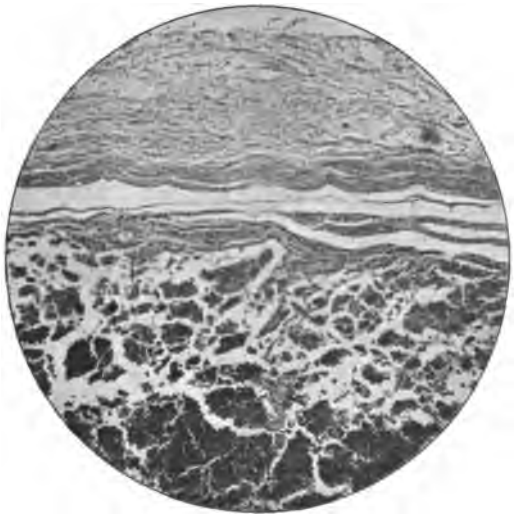

FIG. 54.—Section of a stomach showing round-cell infiltration of the submucosa (sarcoma). (× 100.)

uneven, or even distinctly nodular, and is occasionally superficially ulcerated. If the pylorus is greatly thickened, its orifice may be partially stenosed, as in cases of spheroidal-celled carcinoma; but as a rule the rigidity of its tissues renders it patent and the valve incompetent rather than contracted. The growth gradually shades off towards the centre of the organ, but it is often prolonged for some distance along the curvatures in the form of thick striæ or bands. In almost every instance, whether the pylorus is stenosed or not, the cardia is dilated and its mucous membrane shows signs of chronic inflammation. In about one-sixth of the cases the entire organ was infiltrated

by the growth, which also tended to invade the lower end of the œsophagus and the first portion of the duodenum. The walls of the stomach were greatly thickened and its cavity contracted, while in some instances the inner surface presented extensive superficial ulceration. In only two cases out of the

FIG. 55.—A spindle-celled sarcoma, the size of a small potato, attached to the fundus of the stomach and the gastro-splenic omentum. (London Hospital Museum.)

entire number did the disease occur as a circumscribed tumour in the wall of the viscus, with secondary nodules in the surrounding mucous membrane.

(2) **Spindle-cell or Fibro-sarcoma.**—This variety comes next in order of frequency, and constituted twelve out of the

fifty-three cases, or 22 per cent. It usually presents itself as a round or oval circumscribed tumour of the wall of the stomach in the neighbourhood of the great curvature. As it grows it tends to project more and more beneath the serous coat, and exerts such traction upon its point of origin that it not only drags the whole organ downwards, but often acquires a pedunculated appearance. These tumours sometimes attain an enormous size (12 lb., Cantwell), and may fill the greater part of the abdominal cavity. When small they are smooth and firm on section, but as their bulk increases they become knotty and irregular in shape, and their tissue often undergoes cystic degeneration. These changes are seldom accompanied by extensive adhesions, but occasionally give rise to perforation of the stomach (Ewald).

(3) **The Myo-sarcomata** are much rarer than either of the preceding, only five examples having been recorded up to the present time. They form smooth or slightly nodular tumours in the gastric wall near the great curvature, and frequently show signs of cystic degeneration. Like the fibro-sarcomata, they may grow to an enormous size, Brodowski having met with one which weighed twelve pounds.

(4) **Angio-sarcoma** has been twice recorded (Bruch and Kosinski). In one case it formed a tumour as large as an infant's head, with many cysts, due to interstitial hæmorrhages, scattered through its substance.

Metastases.—Each variety is apt to give rise to secondary growths in organs more or less remote from the primary disease; but the round-cell is by far the most malignant type, for out of twenty-three cases of the latter in which full details are given, sixteen, or 70 per cent., exhibited metastases. In almost every instance the lymphatic glands immediately connected with the stomach were enlarged, and in nearly 50 per cent. were sarcomatous; while in a few cases the retro-peritoneal, mesenteric, and even the mediastinal, cervical, and supra-clavicular glands were affected. . One or both kidneys presented secondary deposits in 28 per cent.; the liver, ovaries, pancreas, adrenals, and omentum each in 14 per cent.; and the lungs, diaphragm, pleuræ, œsophagus, intestine, and mesentery in about 7 per cent. of the cases. It is also important to notice that nodules of growth were present in the skin of the abdomen, thorax, or back in about 12 per cent. of the entire number.

The spindle-cell variety was accompanied by metastases in

the perigastric glands in 37 per cent. of the cases, and in the skin, liver, and diaphragm in 12 per cent. of the cases. In two out of the five cases of myo-sarcoma secondary growths were found in the liver.

Other Points of Distinction from Carcinoma.—Owing to the infrequent infection of the peritoneum there is usually a notable absence of the elongated and nodular epigastric tumour which is so often present in cancerous disease of the stomach from infiltration and adhesion of the great omentum. Again, in about 15 per cent. of the cases of round-cell sarcoma the spleen is so much enlarged as to project below the costal margin. This increase of size is due not to the existence of a morbid growth in its substance, but to congestion and hyperplasia of the splenic pulp, a condition which rarely occurs in carcinoma (see p. 74). Kundrat has observed enlargement of the tonsils, with occasional swelling and ulceration of the follicles of the tongue, and lays considerable stress upon their diagnostic significance; but these phenomena are confined to the round-cell variety and are of rare occurrence. Perforation of the stomach, followed by general peritonitis, takes place in about 11 per cent., and is, consequently, more frequent than in carcinoma, owing probably to the greater tendency to softening of the growth and to the absence of protective adhesions. On the other hand, a perigastric abscess from this cause has not hitherto been observed. Death from hæmorrhage has only once been recorded (Robert), and in one instance the disease gave rise to a gastro-colic fistula. True carcinoma was twice found associated with round-cell sarcoma.

FIG. 56.—Secondary growth of melanotic sarcoma.

Secondary Sarcomata of the stomach are more common than secondary carcinomata, and are usually of the round-cell variety. They have been observed as the result of disease of the retro-peritoneal glands (Maier, Perry), cæcum (Beck), neck, pharynx, gums (Kundrat), rectum, and superior maxilla; also in cases of general sarcomatosis (Malmsten, Carry).

When sarcoma spreads into the stomach by contiguity the pyloric region is often affected by a uniform infiltration, but when the original growth is remotely situated the metastases usually appear as rounded tumours or thick wheals situated in the submucous tissue. These deposits often soften and ulcerate, and may even undergo partial cicatrisation.

Etiology.—The round-cell sarcoma appears to affect both sexes with equal frequency, and to develop at any age from the first to the eighth decade. There is, however, a distinct tendency for it to appear at an earlier period than carcinoma, since the mean age in twenty-nine cases was only thirty-four years. The fibro-sarcomata, on the other hand, have been met with far more frequently in women than in men (nearly 5 : 1), the average age at the time of death being fifty-one years. The only exception to this rule recorded up to the present time is the case of Finlayson's, where a male child died from a fibro-sarcoma of the stomach at the age of three and a half. In two instances where the solid tumour was a myo-sarcoma the patients were males about fifty years of age.

Round-cell sarcoma, like carcinoma, is prone to follow a local injury and to develop in the scar of an old wound. In a case related by Brooks a soft growth originated in the cicatrix of a former bullet-wound of the lesser curvature, and in one which came under the authors' observation a large secondary melanotic tumour was found in the base of a simple chronic ulcer.

Symptoms.—The general symptoms of sarcoma of the stomach are essentially the same as those that accompany carcinoma of the organ (p. 106). One of the earliest and most striking features of the complaint is progressive loss of flesh with failure of physical power. This is most conspicuous in young persons and in those cases where a round-cell growth has given rise to contraction of the pyloric orifice. When the neoplasm affects only a comparatively small area of the stomach, as in the spindle-cell and myo-sarcomata, emaciation is chiefly observed in the later stages of the complaint or

after ulceration has occurred. Anæmia is always present and gradually increases; but if there is continued fever or repeated hæmorrhages occur the pallor develops rapidly, and may rival that met with in pernicious anæmia. It is characterised by a great diminution both of hæmoglobin and red corpuscles, and in one of the recorded cases the colouring matter amounted to only 15 per cent. of the normal a few days before death. Occasionally a slight degree of leucocytosis may be observed, but the increase of white corpuscles which normally occurs after meals (Digestion-leucocytosis) is usually absent. As a rule the appetite fails, especially in the round-cell growth, from the first, and there may be a special distaste for meat; but sometimes the desire for food continues unimpaired throughout (Rasch, Baldy), or anorexia manifests itself only during the last few weeks of life (Maass, Fleiner). Thirst varies with the severity of the anæmia and vomiting. Pyrexia is by no means uncommon in young persons and in those cases in which the neoplasm grows rapidly or undergoes degenerative changes; it may therefore be present throughout the whole course of a round-cell sarcoma or in the later stages of the other varieties. This febrile reaction is usually continuous, but is seldom severe (99–102° F.), and often gives place to an abnormally low temperature for some days before death. Irregular attacks of pyrexia also accompany the development of perigastritis, pneumonia, pylephlebitis, and the formation of secondary growths in the lungs. Albuminuria occurs in about one-sixth of all cases, and is especially frequent in the round-cell sarcomata. It is usually associated with metastases in the kidneys. If vomiting is a prominent feature of the case, the bowels may be confined, but in the round-cell variety diarrhœa is more often encountered than constipation.

Local symptoms are present in almost every instance of round-cell sarcoma of the stomach, but in those varieties which are accompanied by the formation of a localised slow-growing tumour the ordinary phenomena indicative of gastric disease may be entirely wanting. In the case related by Baldy the appetite continued good and there was no complaint either of pain or sickness, although the entire stomach was involved in an enormous tumour; while in another instance (Cantwell), where the growth weighed twelve pounds, the digestive functions remained unimpaired until the end. Robert has

also recorded one in which the first and only indication of an extensive growth was an attack of hæmatemesis.

In about 76 per cent. of all cases abdominal pain is experienced during some period of the disease. It varies greatly, however, in its character and severity. As a rule, it does not amount to more than a sense of fulness and oppression after meals, such as commonly ensues from gaseous distension of the stomach; but in about 15 per cent. of the recorded cases it was described as having been severe and increased shortly after meals. It is interesting to observe that in most of these either the growth was ulcerated or there was considerable invasion of the pancreas or retro-peritoneal glands. Constant and severe suffering is usually indicative of perigastritis or secondary infection of the liver. The solid tumours (fibro- and myo-sarcomata), unless ulcerated internally, are more often accompanied by sensations of weight and dragging than by actual pain.

Vomiting is usually a later symptom, unless the pylorus is contracted. At first it occurs at intervals, but as the stomach becomes dilated it is repeated more frequently, and the ejecta are found to present the usual features which characterise stagnation and decomposition of the food. Vomiting occurring soon after meals and preceded by pain usually indicates ulceration of the growth, while the attacks of incessant retching, attended by the expulsion of mucus, which are apt to appear from time to time, and are often so severe as to preclude the administration of food, result from secondary inflammation of the mucous membrane. In the case of the large solid tumours, vomiting is a less frequent phenomenon (48 per cent.), and seldom appears until after the lapse of from five to seven months. Fæcal vomiting is usually an indication of a gastro-colic fistula.

Hæmorrhage from the stomach is seldom a prominent symptom of round-cell sarcoma, owing to the comparative infrequency of ulceration of the growth. It is probable, however, that capillary oozing is of constant occurrence, since the gastric contents removed by a tube are often found to be mixed with coffee-ground material; while careful examination of the stools may demonstrate the existence of altered blood (Schlesinger). In the spindle-cell variety of the disease repeated attacks of hæmatemesis were observed in nearly half the cases,

and in two instances a severe hæmorrhage was the first symptom to attract attention.

Physical Signs.—A palpable tumour connected with the stomach is an inconstant sign of round-cell sarcoma, and was observed in only about 30 per cent. of the recorded cases. In most instances it is produced by a local thickening of the gastric wall in the region of the pylorus, and was described as a round or oval mass, occupying the right hypochondriac or epigastric region, smooth on the surface, somewhat tender on pressure, and often freely movable. Rapid increase in size can sometimes be observed. In other instances the tumour consists of the entire stomach, and more than once the concomitant enlargement of the spleen has been mistaken for a malignant mass. In the fibro- and myo-sarcomata a tumour is almost always present, and is often so large as to occupy the greater part of the abdominal cavity. If the growth is situated near the great curvature, it is usually detected in the umbilical, left hypochondriac, or lumbar region, where it forms a smooth, firm, painless mass which is dull on percussion and freely movable in all directions. This latter peculiarity affords a marked contrast to the behaviour of a carcinomatous growth in the same position, which soon becomes fixed by extensive adhesions to the neighbouring viscera. In two cases where the tumour was attached to the posterior wall of the stomach it filled the lesser sac of the peritoneum, and was consequently covered by the stomach and transverse colon, although being somewhat pedunculated it could easily be moved from side to side.

Dilatation of the stomach can be detected in every case of sarcoma of the pylorus, and when the orifice is contracted the peristaltic movements of the enlarged viscus are usually visible. When the organ is affected by diffuse infiltration its cavity is contracted and its outlines are obscured by the transverse colon.

Metastatic deposits in the skin constitute an important feature of the disease. As a rule they appear in the form of one or two small nodules in or around the umbilicus; but occasionally they are very numerous and are scattered all over the abdomen, chest, and back. They vary in size from a millet-seed to a small bean, and at first are freely movable in the subcutaneous tissue, but after a time they become adherent to the skin and may even give rise to ulceration. Enlargement

of the supra-clavicular and cervical glands is rarely observed, while sarcomatous infiltration of the tongue is still less common. In one case a correct diagnosis was made by the discovery of a secondary growth in the rectum. Generalisation of the disease is occasionally accompanied by the symptoms of purpura (Redtenbacher).

Chemical examination of the contents of the stomach affords similar results to those met with in gastric cancer. Free hydrochloric acid disappears at an early stage of the complaint (Fleiner, Schlesinger), and fermentation of the food often produces an excess of lactic acid (Dreyer, Maass, Hammerslag). Sarcinæ may or may not be present, and Schlesinger has been able to demonstrate the presence of the Oppler-Boas bacillus, which was supposed to occur only in cases of cancer. The sulphocyanide of potassium in the saliva gradually diminishes as the disease progresses, and finally disappears about one month before death.

Duration and Complications.—It is difficult to estimate the exact duration of a disease which commences so insidiously and is often unaccompanied by definite physical signs for many months. It would appear, however, from a study of the recorded cases, that although the round-cell sarcomata often run their course in three or four months, the average duration of the disease is about fifteen months; while in the case of the spindle-cell and myo-sarcomata life is prolonged on the average for two years and eight months. It will be observed that in both instances the duration of the disease is greater than that of cancer, a result which probably depends upon its lesser malignancy and its lesser liability to produce ulceration of the mucous membrane and stenosis of the pylorus. Death usually occurs from exhaustion, and is often preceded by a semi-comatose state lasting for several days. Perforation of the stomach, followed by general peritonitis, occurs in 10 per cent. to 12 per cent. of the cases of round-cell sarcoma, and may even take place in the spindle-cell form (Ewald), but owing to the absence of adhesions a perigastric abscess is exceptional. Fatal hemorrhage is very rare. In two instances general sarcomatosis tended to shorten the period of life, while in one an attack of tetany similar to that met with in cicatricial stenosis of the pylorus was immediately responsible for the fatal termination (Fleiner). Excessive ascites, albuminuria,

portal thrombosis, and pneumonia all accelerate the natural course of the disease.

Diagnosis.—So far as the recognition of the malignant nature of the disease is concerned, the sarcomata do not offer any particular difficulty. The intractable character of the gastric symptoms, coupled with the progressive emaciation, physical debility, and cachexia, indicates a profound disturbance of the processes of digestion and assimilation, while the discovery of a growing tumour connected with the stomach, or of metastases in other viscera, demonstrates at once the existence of a neoplasm. A more interesting question is the clinical differentiation of sarcoma from carcinoma. A diagnosis of round-cell sarcoma of the stomach may often be made by attention to the following facts: (1) The disease usually occurs before thirty-five years of age, so that the younger the patient, the greater the probability that the malignant affection is sarcomatous in character. (2) In many cases there is slight but continuous pyrexia, accompanied by rapid and profound anæmia, while in carcinoma fever is usually absent during the early stages of the complaint and the cachexia much more gradual in its development. (3) Enlargement of the spleen is by no means infrequent, but is rarely met with in cancer unless the organ is involved in the growth. (4) According to Kundrat, the tonsils are apt to enlarge and the follicles upon the sides of the tongue may become swollen or ulcerated. (5) Secondary deposits in the skin occur in a notable proportion of the cases, and permit of excision and microscopical examination. It should be remembered, however, that sarcomatosis has been met with in true cancer of the stomach (Leube). (6) A large nodular tumour due to infiltration of the omentum, and a greatly enlarged liver with secondary growths in its substance, are rarely met with. (7) Persistent albuminuria is often observed in sarcoma but is exceptional in cancer. (8) The discovery of pieces of morbid growth in the vomit renders the diagnosis certain (Riegel, Westphalen).

The spindle-cell and myo-sarcomata are chiefly characterised by their comparatively slow growth, a smooth, firm, and movable tumour, the frequent absence of pain, vomiting, and anorexia, and by the tendency to repeated hæmorrhage.

When the tumour occupies the lesser sac of the peritoneum it may be mistaken for a cyst of the pancreas. It should be

noticed, however, that in the latter disease pain after food, vomiting, and hæmatemesis are usually absent, while the tumour itself is firmly fixed, is smooth, elastic to the touch, and tends to come forward between the lower border of the stomach and the colon. In every case of doubt an exploratory operation should be undertaken.

Treatment.—The medicinal treatment is the same as that of gastric cancer. The diet must be carefully regulated and the food peptonised if necessary. Symptoms of fermentation may be allayed by the administration of antiseptics and the employment of lavage, while severe pain requires the exhibition of morphine and other sedatives.

Many of the recorded cases have been subjected to surgical treatment, with considerable success so far as the immediate objects of the operation were concerned. Török, Dock, Schopf, and others have removed considerable portions of the stomach affected by the round-cell growth, and in at least one case (Schopf) there was no recurrence at the end of a year. The solid tumours are especially favourable for extirpation, as they are often pedunculated and involve a comparatively small area of the gastric wall. Hartley removed a large fibro-sarcoma and Kosinski a cystic angio-sarcoma with apparent success; while in Cantwell's case the excision of a spindle-cell sarcoma weighing twelve pounds gave great relief to the patient for eight months. If one may judge from the morbid anatomy of the disease, the surgical treatment of sarcomata of the stomach will prove far more successful than can ever be expected in carcinoma, but it is too early as yet to determine the prospects of a permanent cure.

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CHAPTER II

CARCINOMA AND SARCOMA OF THE DUODENUM

CARCINOMA affects the duodenum as a primary disease much less frequently than the stomach. In the course of 42,000 post-mortem examinations made in Vienna, a primary malignant growth was found in the intestines in 443 cases, but in only seven, or 0·017 per cent., was the duodenum the seat of the disease (Schlesinger). According to Perry and Shaw, ten examples of the complaint occurred in 18,000 necropsies performed at Guy's Hospital (0·05 per cent.), but of these only four are stated to have been carcinomatous; while among 19,518 post-mortems recorded at the London Hospital, we find that the duodenum was the seat of a cancerous growth in eighteen, or in about 0·09 per cent. If allowance be made for the occasional inclusion of sarcomata in the latter statistics, it would appear that primary carcinoma of the duodenum is met with once in about 1,500 to 2,000 necropsies in London, and thus presents a ratio to gastric cancer of 1 to 20. According to the statistics of Maydl and Schlesinger, the duodenum is affected in about 2 per cent. of the cases of primary malignant disease of the intestine.

The great majority of duodenal cancers belong to the cylinder-celled variety, but spheroidal-celled growths are not uncommon, and Atkinson states that colloid cancer is relatively frequent. Adeno-carcinoma usually encircles the gut, and gives rise to a contraction of its lumen which, viewed from the outside, looks as though a piece of string had been tied tightly round the bowel. Less commonly the growth infiltrates the walls for some distance above the stricture, and gives the diseased tissues a funnel-shaped appearance. The spheroidal carcinomata either take the form of soft flat excrescences, or of deep ulcers with elevated irregular edges and fungating bases.

The disease may occur at any part of the duodenum, but is most frequent in the second or vertical portion, where its seat of election is the mucous membrane covering the biliary papilla. Out of fifty-one cases which we have collected, the first part was affected in eleven, or 21·5 per cent., the second in twenty-nine, or 57 per cent., and the third in seven, or 13·5 per cent.,

FIG. 57.—Primary carcinoma of the first part of the duodenum, involving the pylorus. (London Hospital Museum.)

while in the remaining 8 per cent. the disease involved the whole or greater portion of the duodenum.

Secondary Carcinoma is usually the result of an extension of the disease from a neighbouring organ. In the majority of the cases the head of the pancreas is the seat of the primary mischief, but in not a few of these it probably commenced in the lining membrane of the ampulla of Vater. In others the

duodenum is involved by a growth of the gall-bladder, of the bile-duct, of Wirsung's duct of the pancreas, of the omentum, of the retro-peritoneal glands, or of the right adrenal. The first part is also apt to be invaded by a growth of the pylorus (p. 58).

Multiple Carcinomata are occasionally encountered, but they almost always arise either by contact infection or by transplantation of particles detached from a growth higher up. In rare instances cancer of the duodenum is associated with cancer of the stomach or of the œsophagus (Lannois and Courmont).

Primary Sarcoma of the duodenum is very rare, and only about twenty-cases have been recorded. As a rule the disease is of the round-cell variety, and involves all three portions of the bowel, while not infrequently the jejunum and ileum are also affected. The wall of the gut is greatly thickened, but its lumen is more often increased than diminished (Libman). The growth may compress the biliary and pancreatic ducts (Lancereaux), or it may give rise to extensive ulceration and lead to fatal hæmorrhage (Rolleston).

Secondary Sarcomata chiefly occur in cases of melanosis or of lympho-sarcoma of the retro-peritoneal glands.

Etiology.—Like simple ulcer in the same situation, carcinoma is more frequent in men than in women, no fewer than thirty-seven out of our fifty-one cases having been of the male sex. The average age at the time of death was fifty-three years, the mean duration of life in the male cases being fifty-two years, and in the female fifty-four years. Nattan-Larrier, however, found that in rather more than one third of the cases he collected the patient was over seventy years of age. The disease is apt to follow a chronic ulcer, at least ten instances in which this sequence of events occurred having been placed on record (Perry and Shaw, Nattan-Larrier, Letulle). In other cases, and more especially in women, the carcinoma is associated with the presence of gall-stones.

Symptomatology.—The symptoms of duodenal cancer vary according to the situation of the growth. When the first or horizontal portion of the bowel is affected the patient presents all the indications of pyloric stenosis, and a differential diagnosis is extremely difficult. Disease of the second or vertical part is apt to involve the orifice of the common bile-duct, so that its location may often be determined during life by the

coexistence of jaundice and enlargement of the liver; while a stricture of the duodenum below the biliary papilla is usually attended by bilious vomiting and the presence of pancreatic juice in the ejecta. It is therefore convenient to consider the clinical aspect of the disease, according as it is situated *above*, *around*, or *below* the biliary papilla.

(1) **Carcinoma above the Biliary Papilla** (*Supra-ampullary or Parapyloric Cancer*).—In this position the growth may either form a ring round the bowel, just below the pylorus, or produce a deep ulcer with overhanging edges, the base of which is adherent to the liver or pancreas. In both cases the lumen of the intestine is considerably diminished, though never entirely obstructed. The complaint is chiefly encountered in men of middle age, and sometimes follows simple ulceration.

The initial symptoms are somewhat indefinite, and principally consist of discomfort and flatulence after meals, acidity, loss of appetite, and general debility. There is also slight but progressive loss of flesh, with marked pallor of the mucous membranes. After a month or two pyrosis makes its appearance, and is followed within a short time by vomiting. At first the emesis may occur only about once a week, and is followed by an amelioration of the other symptoms; but it gradually becomes more and more frequent, until finally it takes place once or twice every twenty-four hours. The vomit consists of an acid sour-smelling liquid, mixed with masses of undigested food. Free hydrochloric acid is usually absent, but lactic acid may be present in excess. It is generally stated that the ejecta are free from bile, but as a matter of fact a severe attack of retching is not infrequently accompanied by the rejection of a green bilious fluid which has regurgitated through the incomplete stricture. At this period severe pain may be experienced in the epigastrium or right hypochondrium shortly after meals, and is almost always an indication that the growth has undergone superficial ulceration. Hæmatemesis is less frequent than in cancer of the stomach, but traces of altered blood may sometimes be observed in the stools, and occasionally there is severe melæna. In the early stages of the complaint the bowels are confined, but subsequently diarrhœa may supervene and prove difficult to control. Bile is usually present in the stools, and, according to Charon and Ledegank, colloid material may often

be recognised in the evacuations when the disease has undergone that form of degeneration.

On examination the stomach is found to be greatly dilated, and its contractions are often visible through the abdominal wall. In about 60 per cent. of the cases in which the disease is situated close to the pylorus a tumour may be detected upon palpation, and is sometimes large enough to be evident upon inspection. It is usually oval or globular in shape, smooth on the surface, dull on percussion, painful, and slightly movable; but if it is adherent to the liver or pancreas its outlines are less definite, and the presence of the colon in front of it may endow it with a resonant note.

The subsequent course of the disease is similar to that of pyloric cancer. Ascites may occur from carcinoma of the peritoneum or pressure upon the portal vein, while jaundice may result from secondary growths in the liver or from an extension to the biliary papilla. Perforation into the general cavity of the peritoneum is a rare event, but a slight leakage not infrequently gives rise to a localised abscess, which burrows upwards to the diaphragm or points near the umbilicus.

(2) **Carcinoma in the Vicinity of the Biliary Papilla** (*Cancer of the Second Portion of the Duodenum or Periampullary*).—In the second part of the duodenum the growth may commence either in the mucous membrane covering the papilla, or at some spot in its vicinity. In the former case the first indication is usually jaundice, while in the latter the signs of pyloric or intestinal obstruction precede those which arise from occlusion of the bile-duct.

Carcinoma of the papilla is usually of the cylinder-celled type, and takes the form of a soft growth, which subsequently ulcerates. As a rule, a yellow tinge of the skin and conjunctivæ is the first symptom to attract attention, and it may be several weeks before pain or vomiting develops. In other cases the icterus occurs quite suddenly after an attack of sickness, or its onset may be heralded by repeated chills and intermittent pyrexia. It is worthy of notice that the colouration of the skin is seldom very intense, and that the bronzed or olive tint that accompanies malignant disease of the bile-duct is rarely observed, while not infrequently the jaundice alternately deepens and fades, or appears to be favourably affected by saline aperients. When ulceration occurs, the growth which

obstructed the orifice of the duct may be quite destroyed, and the bile may once more find a free exit into the bowel. Under these conditions the icterus either disappears completely or the urine alone continues to give indication of the presence of bile in the circulation.

The course of the disease depends upon the extent of the growth and the development of complications. As a rule, the jaundice continues with varying intensity, and the patient steadily loses flesh and strength. The appetite is often better preserved than in gastric cancer, but there is usually great distaste for fats, and sometimes excessive thirst. The tongue is foul, pain and flatulence are experienced two or three hours after every meal, and constant nausea or eructation of sulphuretted hydrogen is a frequent source of complaint. Vomiting is seldom absent, and at this stage of the disease usually occurs once or twice a day. The ejecta are copious in quantity, and consist of a brownish sour-smelling fluid, which deposits a thick sediment of undigested food, and is usually devoid of free hydrochloric acid. Notwithstanding the presence of jaundice and the absence of bile from the stools, the vomit occasionally exhibits a bright green colour. Hæmatemesis is comparatively rare, but altered blood is not infrequently observed in the evacuations.

On examination, the epigastrium is found to be slightly distended, and there may be some degree of rigidity of the right rectus muscle. The liver is invariably enlarged, and its lower border extends for an inch or more below the costal margin. Careful palpation will also reveal the presence of a distended gall-bladder, in the form of an elongated elastic tumour, which is attached to the under surface of the liver and is capable of slight lateral displacement. At first it is situated near a vertical line drawn from the tip of the ninth rib, but as the liver enlarges it may be pushed several inches to the right. A

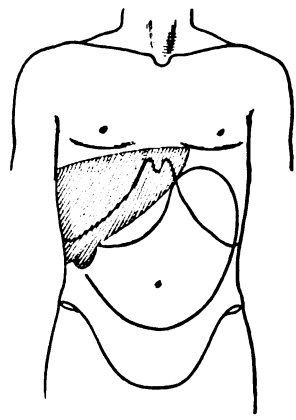

FIG. 58.—Diagram illustrating the physical signs of dilatation of the stomach and first part of the duodenum, with enlargement of the liver and gall-bladder.

tumour due to the intestinal growth can seldom be detected, but if the pancreas, retro-peritoneal glands, or the omentum are invaded, a hard nodular and painful mass may be felt in the region of the navel. Dilatation of the stomach is always present, and in many cases the contractions of its hypertrophied walls are visible through the abdominal parietes. Although death usually ensues from inanition at the end of six to eight months, it may occur at a much earlier period from biliary toxæmia or other complications.

Case XXII. A woman, aged fifty-four, was admitted into the London Temperance Hospital in a comatose condition, with deep jaundice. Her husband stated that about nine weeks previously she had been seized with pain and sickness after eating some pickled pork, and on the next day had become yellow. The appetite had been bad, and she had complained of feeling weak, but had not lost flesh to any appreciable extent. Two days before admission into the hospital she had become drowsy and had vomited several times. The patient was a stout well-developed woman. The skin was bright yellow, and the urine contained a large quantity of bile, but no albumin or sugar. There was profound coma with laboured respiration, a slow feeble pulse, and dilated pupils. The liver extended nearly three inches below the margin of the ribs, and presented a sharp edge and smooth surface. The gall-bladder formed a well-defined tumour to the right of the mammary line. The stomach appeared to be normal in size, and no abdominal tumour could be detected. The gastric contents, extracted by a tube, contained a trace of free hydrochloric acid. Death took place in a few hours.

Necropsy. The liver was much enlarged, and its tissue deeply bile-stained. The gall-bladder contained eight ounces of green bile, and the cystic, hepatic, and common bile-ducts were greatly dilated. When the duodenum was opened, an ulcer the size of a shilling, having a hard irregular edge and fungating base, was found to occupy the position of the biliary papilla. Vater's ampulla was dilated, and its opening on the floor of the ulcer was obscured by a small fungoid growth. There were no secondary deposits in the liver, but three lymphatic glands behind the peritoneum were enlarged. The duodenal growth proved to be a cylindrical-celled carcinoma.

Occasionally the patient is attacked by a succession of rigors, accompanied by irregular pyrexia and delirium. Severe pain is experienced in the right hypochondrium and epigastrium, and vomiting is urgent. Rapid enlargement of the liver takes place, the jaundice deepens, and death usually occurs

within a week. In a case of this kind which recently came under our care, carcinoma of the head of the pancreas with portal pyæmia was diagnosed, but the necropsy showed a small cancerous growth of the biliary papilla, with purulent infiltration of the hepatic and pancreatic ducts.

In rare instances suppurative cholecystitis results from a pyæmic infection of the bile-duct, and may terminate by perforation of the gall-bladder, as in the following case recorded by Cockle :—

Case XXIII. A coal porter, aged fifty-three, was admitted into hospital on February 5, 1883, for slight jaundice. He had enjoyed fairly good health until Christmas, when he caught cold. Since then he had had slight rigors and had lost flesh and strength, but had not complained of pain. On admission the patient was emaciated and slightly jaundiced. The margin of the liver extended about one inch below the ribs in the nipple line. There was neither pain, œdema of the legs, nor ascites ; the fæces were pale.

February 15.—Rigors ; temperature, 101·2° ; pulse, 100.

February 17.—Jaundice more intense ; liver dulness extended three and a half inches below the costal margin. From the lower border of the liver, and continuous with it, there seemed on palpation to be an enlargement of firm consistence, which extended to within two inches of the iliac crest and yielded a resonant note on percussion, being apparently overlapped by the distended colon. Swelling not tender. Patient very drowsy and thirsty. Temperature, 103·2°.

February 19.—Jaundice increased ; swelling larger ; liver dulness reached iliac crest ; no pain, but tenderness on palpation over the liver.

February 20.—The localised swelling had increased in size, and fluctuation could be detected. Slight œdema of the abdominal wall ; patient weak and torpid, with hectic flush on cheeks ; pulse, 100 ; temperature, 102·7°.

February 21.—Patient suddenly became worse ; acute pain in the abdomen, which was distended and tympanitic. Died on the following day.

Necropsy. The peritoneal cavity contained several pints of serobilious fluid and about a quarter of a pint of pus, which escaped from a perforation in the gall-bladder. The intestines were coated with recent lymph and the coils glued together. The gall-bladder was enormously dilated, and measured when empty eight inches in length and four and a half inches in width. On its under surface was an opening the size of a sixpence, with thickened and ragged edges. The common bile, cystic, and hepatic ducts were all dilated. On opening the duodenum a soft growth was found, entirely surrounding the orifice of the bile-

duct and invading the intestine for three inches in its long axis, and involving half its circumference. Above the growth the bowel was much dilated. The lymphatic glands in the neighbourhood were enlarged, but there were no metastases in the liver.

When the carcinoma only invades the biliary papilla during the course of its growth the clinical picture it presents is somewhat different from the preceding. Should the disease have commenced high up, the initial symptoms are those of pyloric obstruction. Pain or discomfort is experienced two or three hours after food, and there are usually flatulence, acidity, and vomiting, with signs of hypertrophy and dilatation of the stomach. The vomit is devoid of free hydrochloric acid, and occasionally it presents a green colour, owing to regurgitation of bile through the partially obstructed bowel. Hæmatemesis and melæna may occur from ulceration of the growth, and may even prove fatal. Should the disease undergo colloid degeneration, small semi-transparent granules of colloid material sometimes appear in the fæces.

If the growth develops below the level of the papilla, the first symptoms are those of obstruction of the bowel, with constant vomiting of bilious fluid containing trypsin. In either case its extension to the orifice of the bile-duct is followed by jaundice, with enlargement of the liver and gall-bladder. It should be noticed, however, that even when this complication ensues a certain amount of bile may still appear in the vomit or fæces, while in some cases the only indications of biliary obstruction consist of the presence of bile in the urine and distension of the gall-bladder.

(3) **Carcinoma below the Biliary Papilla** (*Cancer of the Third Portion of the Duodenum, Infra-ampullary or Juxta-jejunal*).—This usually occurs in the form of an annular growth, which produces a considerable degree of stenosis. Both the stomach and the duodenum above the disease are much enlarged, and the pyloric orifice is dilated. As in the preceding varieties, the first symptoms consist of flatulence and discomfort after meals, acidity, loss of appetite, and gradual emaciation. After the lapse of a few months vomiting appears, and persists until the end. The tongue now becomes thickly coated, the thirst excessive, and there is marked cachexia and rapid loss of flesh. The bowels are obstinately confined, but the stools are seldom quite devoid of bile, and occasionally contain altered blood.

The character of the vomit constitutes one of the most important features of the disease. It always contains bile, which gives it a bright green colour, and if the patient is restricted to a semi-solid diet, the ejecta may closely resemble chopped spinach. The liquid obtained by filtration is neutral or slightly alkaline in reaction, and if warmed to the temperature of the body is usually capable of digesting fibrin, owing to the fact that it contains pancreatic juice. The sediment that remains upon the filter consists of undigested food in a state of fine subdivision, and is quite unlike the bulky masses which are vomited in cases of pyloric stenosis. From time to time attacks of intestinal obstruction supervene, attended by incessant vomiting and obstinate constipation. On these occasions from ten to fifteen pints of an alkaline bilious fluid may be vomited in the course of twenty-four hours, notwithstanding the fact that the patient has taken nothing by the mouth. The urine is greatly reduced in amount, and may even be suppressed, while that which is voided is alkaline in reaction and opaque from an excess of earthy phosphates. When boiled with nitric acid, it sometimes assumes a dark red or port-wine colour, owing to the presence of a colourless chromogen, allied to indol and indican, which has been produced by decomposition in the dilated bowel. A similar reaction is sometimes obtained in cases of melanosis, owing to the existence of melanogen in the urine; but in this instance the addition of perchloride of iron produces a brown colouration—a reaction which is absent in cases of duodenal cancer. In rare instances the chromogen is changed to indican in the body, and the urine has a distinct blue colour when voided. Rolleston noted an excess of creatinin in the case which he recorded. Symptoms of auto-intoxication are often present at this stage of the complaint, and consist of urgent dyspnœa, restlessness, palpitation, thirst, and delirium. Intense itching of the skin, like that met with in biliary and renal toxæmias, is sometimes observed, and urticarial eruptions occasionally follow the acute attacks of duodenal obstruction. Examination of the abdomen shows the stomach to be much enlarged, and a succussion splash may be obtained as far outwards as the right mammary line, or even in the lumbar region. This latter phenomenon is apt to be ascribed to dilatation of the pyloric region of the stomach, but is really due to the duodenum, which, being greatly enlarged above the stricture,

forms a distended sac behind and to the right of the pylorus. When the disease merely forms a narrow ring round the bowel, no tumour can be detected by palpation, but if the growth is accompanied by enlargement of the retro-peritoneal glands, or has infiltrated the pancreas, an ill-defined hard mass may be felt to the right of the umbilicus. Exploration of the stomach with a soft tube elicits three facts of considerable importance. In the first place, it may be observed that after the organ has been apparently emptied a fresh gush of fluid occurs when the patient coughs or inclines his body to the left side, a phenomenon which is obviously due to regurgitation of the contents of the duodenum through the incompetent pylorus. Secondly, after the stomach has been evacuated a succussion splash may still be obtained over a limited area to the right of the navel, owing to the presence of fluid in the duodenum. Finally, after the stomach has been washed out overnight, and no food taken in the meanwhile, a quantity of bilious fluid may be extracted in the morning. These three phenomena, taken in conjunction with the physical signs aforementioned, render the diagnosis of stricture of the third part of the duodenum almost a matter of certainty.

Case XXIV. A carpenter, aged fifty-six, was admitted into the London Temperance Hospital with the following history. He had always been in good health until five months previously, when he was suddenly seized with a bilious attack, and vomited for two days. Since that time he had suffered from flatulence and discomfort after meals, loss of appetite, and steady emaciation. Latterly he had vomited once or twice each day, and had become very weak. The bowels were confined, and micturition was accompanied by a scalding pain in the penis. On examination the patient was found to be very thin and anæmic, with a purple flush on either cheek, which was stated to have developed during the course of his illness. The pulse was small and compressible, the tongue covered with a creamy fur, the breath offensive, and the temperature sub-normal. The bowels were confined, but the stools contained bile. The lower border of the stomach extended nearly one inch below the level of the navel, and its pyloric portion appeared considerably dilated, since a succussion splash could be obtained as far outwards as the right anterior axillary line. The organ could be seen to contract slowly from left to right. The liver was enlarged, and the lower edge projected one inch below the costal margin (fig. 59). There was neither ascites nor jaundice, nor could any localised tenderness or tumour be detected in the

abdomen. The thoracic viscera were normal. The vomit during the first night in the hospital amounted to eighteen ounces, and consisted of an alkaline opaque fluid of a deep green colour, which deposited a flocculent precipitate on standing. Gmelin's test gave a positive reaction, and after the addition of a few grains of bicarbonate of sodium the filtrate digested fibrin. The urine was much reduced in amount, and contained a trace of albumin. After the stomach had been washed out overnight, and no food taken in the interval, thirteen ounces of bilious fluid were extracted by a tube on the following morning, and even after the organ had been apparently emptied a splash could still be obtained to the right of the umbilicus. Daily lavage, combined with careful dieting, afforded considerable relief for the first ten days, but the loss of weight still continued. At the end of a fortnight it was noted that the patient was not so well. Vomiting

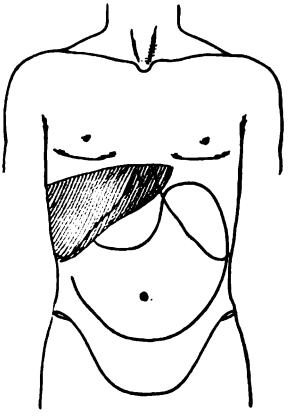

FIG. 59.— Physical signs in Case XXIV.

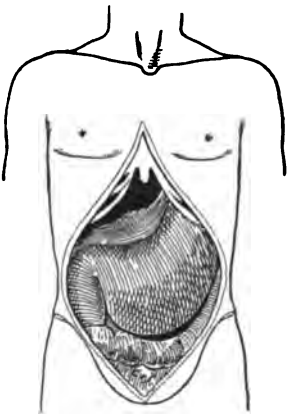

FIG. 60.—Post-mortem appearances in Case XXIV.

occurred each night despite the lavage, and the right lobe of the liver had increased in size and presented a small superficial nodule. Attacks of extreme restlessness alternated with periods of somnolence, and at night-time he suffered from fits of choking, accompanied by urgent dyspnœa. On the eighteenth day after admission the bowels ceased to act and incessant vomiting set in, which lasted for three days and precluded the administration of nourishment by the mouth. During this period from six to nine pints of a thin alkaline green fluid were ejected every twenty-four hours. The urine was scanty, and assumed a dark red tint when boiled with nitric acid. A week later fluid was detected in the peritoneal cavity, and the patient complained of great distension after meals. A gland above the left clavicle was also found to be enlarged, and the nodule in the right lobe of the liver was more distinct. A few days afterwards the temperature

suddenly rose to 101° F., and he became delirious. There was no cough or expectoration, and the respirations were only twenty-four per minute. The following day the temperature had fallen to 99°, but the patient was semi-unconscious, with a dry tongue and a pulse-rate of 136. Comparative dulness on percussion was detected at the base of the right lung, and a few moist crepitations were audible on auscultation. During the evening the temperature rose to 102°, the coma deepened, and death occurred in the early morning.

Necropsy.—The anterior portion of the abdominal cavity was chiefly occupied by two thin-walled sacs, which lay side by side. The one on the left consisted of a dilated stomach, while the other, which was ovoid in shape and eight inches in length, with a maximum circumference of thirteen inches, represented the upper two thirds of the duodenum in a state of extreme distension (fig. 60). When the latter was laid open, its lower end was found to be the seat of an ulcerated malignant growth, which had so contracted the lumen of the bowel that it hardly admitted the tip of the index finger. The retro-peritoneal glands were much enlarged, and the liver contained four secondary growths. There was recent pneumonia in the lower lobe of the right lung. The growth was a columnar-celled carcinoma.

Cases have been recorded in which the whole or greater part of the duodenum was infiltrated with carcinoma, and converted into a thick rigid tube of small diameter. The symptoms that accompany this rare form of disease are essentially those of chronic intestinal obstruction, accompanied by excessive vomiting and dilatation of the stomach. Jaundice is an inconstant phenomenon, but melæna is not infrequent. In Arrachard's case a large membranous cast was evacuated after the administration of an aperient, and death was preceded by troublesome diarrhœa.

Duration and Complications.—In our series of cases the average duration of the complaint was about seven months, the extreme limits being three and eighteen months. As a rule the fatal event is due to exhaustion from inanition, but when it occurs at an early period it may take place from auto-intoxication or some other complication. Fatal hæmorrhage has been recorded only twice, and perforation, with general peritonitis, is rare. An intra-peritoneal abscess is rather more common than in simple ulcer, and usually points at the umbilicus or makes its way towards the upper surface of the liver. Suppuration behind the peritoneum is very exceptional. Occasionally the growth produces an external fistula, or

establishes a communication with the transverse colon or with the gall-bladder. In the case recorded by Trevelyan death occurred from tetany.

Diagnosis.—Primary malignant disease of the duodenum is accompanied by two varieties of symptoms, one of which is common to all cases, while the other varies with the situation of the growth. The former comprises progressive emaciation, cachexia, loss of appetite, vomiting, hæmatemesis or melæna, constipation alternating with diarrhœa and pain in the abdomen after meals, with the signs of dilatation of the stomach, and perhaps a palpable tumour. The latter, or localising symptoms, on the other hand, consist of jaundice with enlargement of the liver and distension of the gall-bladder, attacks of intestinal obstruction, vomiting of bile and pancreatic juice, the presence of a chromogen in the urine, and the signs of dilatation of the stomach and duodenum.

Disease of the *first part of the duodenum* has to be distinguished from benign and malignant strictures of the pylorus, and from the effects of pressure exerted upon the bowel by an external tumour.

1. Pyloric stenosis due to the cicatrisation of a simple ulcer develops very gradually, and is seldom accompanied by rapid emaciation or cachexia. There is almost always a history of previous severe pain after food, with one or more attacks of hæmatemesis. Pain and acidity are chiefly experienced during the night, and the vomit may be stained with bile. Free hydrochloric acid is present in excess, and the existence of hypersecretion may be determined by evacuating the stomach in the early morning. Although the viscus may be greatly dilated and hypertrophied, no tumour can be felt, and if suitable treatment is adopted the general health may continue good for many years.

2. From cancer of the pylorus the diagnosis is very difficult, since the symptoms and signs of the two diseases are practically identical. It is stated, however, that when cancer attacks the upper duodenum the appetite is less affected than in the gastric complaint, that free hydrochloric acid may continue for a considerable time, that bile is not infrequent in the vomit, and that diarrhœa is apt to alternate with constipation. If a tumour is present, it is usually situated more to the right of the median line than is the case with a pyloric growth.

3. Pressure upon the first part of the duodenum may be caused by an enlarged gall-bladder, a tumour of the liver, an aneurysm of the cœliac axis or of the hepatic artery, or by a growth of the omentum, kidney, pancreas, or retro-peritoneal glands. These forms of obstruction develop more slowly and are less severe than that produced by cancer of the duodenum. Hæmatemesis and cachexia are rare, and the loss of flesh is often proportional to the urgency of the gastric symptoms. The tumour varies in its character and attachments according to its mode of origin, and free hydrochloric acid may usually be detected in the gastric contents.

Malignant disease of the *second part of the duodenum* may be confused with cancer of the pancreas or of the ampulla of Vater, with gallstones, and with a simple chronic ulcer in the same situation.

1. A growth of the head of the pancreas, or of the small diverticulum into which the common bile and pancreatic ducts open (ampulla of Vater), is accompanied from the first by jaundice, which soon becomes intense, and usually persists throughout the whole course of the disease. The gastric phenomena, on the other hand, are of subordinate importance, and mainly consist of flatulence after meals, a bitter taste in the mouth, and inability to digest fats. The stomach is not dilated, there is no periodic vomiting, bile is absent from the stools, and the secretion of hydrochloric acid usually persists.

2. Gallstones are more common in women than in men, while the reverse is the case with duodenal cancer. The jaundice is preceded by severe spasmodic pain, and may continue for several months without seriously affecting the general health. Even when emaciation is a marked feature of the case, the patient does not usually display that loss of energy and physical debility which is so constant in cancer of the digestive organs. Periodic vomiting, with the signs of dilatation of the stomach, is absent, there is no hæmatemesis or melæna, and the initial enlargement of the gall-bladder disappears after a short time.

3. Simple chronic ulcer of the duodenum is usually accompanied by pain some hours after food, with tenderness on pressure above and to the right of the navel, and by occasional attacks of melæna, with or without hæmatemesis. Loss of flesh and appetite is an unimportant symptom, and the degree of anæmia varies with the severity of the hæmorrhage. Should

the disease ultimately produce stenosis of the bowel, the gastric dilatation is accompanied by hyperchlorhydria.

Obstruction of the *third part of the duodenum* may arise from other causes than malignant stricture, since a tumour of any neighbouring viscus may exert pressure upon the bowel. It is also possible that undue tension of the transverse mesocolon, or enlargement of the superior mesenteric vessels, may compress this portion of the gut. Of the internal diseases, the impaction of a gall-stone and the cicatrisation of a simple ulcer are the most important. In all these cases, however, the antecedent symptoms differ greatly from those of duodenal carcinoma; there is seldom cachexia or rapid loss of flesh, and the discovery of a tumour helps to elucidate the nature of the primary disease. A gastro-biliary fistula is also accompanied by vomiting of bile, but there is usually a history of gallstones, while dilatation of the stomach and duodenum is absent.

Treatment.—This must be conducted upon the same lines as that of cancer of the pylorus. Lavage should be performed night and morning, the bowels maintained in regular action, and the diet adjusted to the necessities of the patient. Excision of the growth is rarely feasible, but gastro-enterostomy often prolongs life for several months.

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CHAPTER III

POLYPI AND PEDUNCULATED TUMOURS OF THE STOMACH

POLYPOID tumours are occasionally met with in the stomach, and may be classified according to their histological structure as pedunculated adenomata, fibromata, lipomata, and myomata. The so-called 'mucous polypus' is really a small adenoma which has undergone cystic changes, but since it differs considerably from the ordinary form of that disease it is convenient to describe it as a separate variety.

(1) **Mucous Polypi (Polyadenomata).**—These tumours appear to be more common on the continent of Europe than in England or America, since Ebstein met with fourteen cases in 600 necropsies (2·3 per cent.), while in London, according to our statistics, their frequency of occurrence does not exceed 0·2 per cent. Out of thirty-four cases which we have collected from various sources the tumour was solitary in fourteen, or 41 per cent., while in the remaining twenty, or 59 per cent., the number varied from six to 200 (Cruveilhier, Roullier, Brissaud, Leudet). A single polypus is usually situated near the pylorus, but in the multiple form of the disease the fundus and central portions of the viscus in the vicinity of the great curvature are principally affected. As a rule the tumours are distributed evenly over the two surfaces, but occasionally they are collected into groups of five or more (Cruveilhier), or are arranged in rows which run parallel with the long axis of the organ (Richard). The intervening mucous membrane may be quite healthy, or it may present numerous hemispherical swellings about the size of a split pea, which represent the disease in its rudimentary form. It is not uncommon to find a single polypus surrounded by several others in the process of formation.

As a rule the mucous polyp is globular or slightly lobulated,

and looks like a small nut attached to the surface of the stomach by a short flat stalk; but it may be cylindrical or club-shaped, or it may present the appearance of a mushroom. The solitary tumour may measure from one to four inches in length (Ebstein); but when several exist the individual polypi are remarkably uniform in size and seldom exceed three-quarters of an inch. The colour varies, according to the degree of vascularity, from a bright pink to a pale brown, and the surface, when freed from adherent mucus, is often found to be irregular and pigmented. The consistence is soft and slimy, and when firmly squeezed a large quantity of greyish mucus exudes from the tissue and the tumour is reduced to about one third of its original size. Occasionally the duodenum and ileum, or even the whole of the intestinal tract, are affected in a similar manner. On microscopical examination the centre of the tumour is found to consist of a strip of connective tissue, which is continuous with the submucous coat of the stomach and contains blood-vessels and lymphatics. Over this is spread a layer of unstriped muscle, which represents the muscularis mucosæ in an hypertrophied state. The great bulk of the growth is composed of mucous membrane, which is from five to

FIG. 61.—Mucous polypi in the stomach. (Museum of the Royal College of Surgeons.)

twelve times its normal thickness. The free surface often presents a papillary appearance, owing to hypertrophy of the connective tissue between the mouths of the ducts, and is sometimes covered with cylindrical epithelium. The gastric glands are elongated, dilated, and tortuous, and here and there are converted into large cysts filled with mucus. These dilated glands closely resemble the uriniferous tubules in the cortical portion of the kidney, being provided with a distinct basement membrane and lined by cubical or cylindrical epithelium, while in the cysts the cells are often rounded and vacuolated. Ménétrier distinguishes two varieties, according as the ducts or the fundi of the glands are chiefly affected. In the former case the tumour is distinctly lobulated and the cysts are numerous and large, owing to obstruction of the mouths of the ducts by fusion of the papillary processes between them. In the latter there is little or no lobulation, and cysts are either few in number or entirely absent. The intervening mucous membrane presents the usual signs of chronic inflammation, and its vessels are occasionally lardaceous.

Very little is known with regard to the etiology of the disease. Out of thirty-two cases in which the sex of the patient was stated, twenty-two were males and ten were females. The complaint is rare before the age of forty, but the tendency to it seems to increase with advancing age. This fact is shown in the following table.

TABLE 36

Age	No. of cases	Percentage
Under twenty-five . . .	1	3·4
Thirty to forty	3	10·3
Forty to fifty	7	24
Fifty to sixty	8	27·6
Sixty to seventy . . .	6	20·7
Seventy to eighty . . .	2	7
Eighty to ninety . . .	2	7
Total	29	100

Andral and Cruveilhier regarded a polypoid condition of the gastric mucous membrane as a result of chronic inflammation, and Camus-Govignon considered that the abuse of alcohol was an important factor in its causation ; but in a large proportion of the recorded cases there was no history of indulgence

in alcohol (Quinquaud, Richard, Liouville). In several instances the patient was either a lunatic or subject to epilepsy, and in such the disease often developed at an unusually early age (Barr Stevens, Norman). According to Ménétrier the gastric complaint is often associated with fibroid tumours of the uterus or ovaries, and with atheroma of the large arteries.

(2) **Pedunculated Adenomata.**—These occur in the form of round, smooth, or lobulated tumours, of a greyish-brown colour and firm consistence, which are attached by short thick stalks to the mucous membrane in the pyloric region. When solitary they may attain the size of an apple, or even of the fœtal head at term (Chaput), but if several exist they seldom exceed the dimensions of a walnut and may be as small as peas. In one instance which came under our observation four pedunculated adenomata, each as large as a pigeon's egg, were found attached to the margin of the pyloric ring, and had produced partial obstruction of the orifice. On section the growth is firm and smooth, and sometimes presents several small cysts filled with brownish mucus. Under the microscope it is found to consist of tubular glands, supported by connective tissue and well supplied with blood-vessels, while the mucous membrane which covers it is affected by chronic interstitial inflammation.

It is often impossible to draw a hard and fast line between a large adenoma and an adeno-carcinoma, since the structure may be very similar in the two cases and death may occur in the malignant disease before the formation of metastases. It is also probable that a simple adenoma sometimes assumes a malignant character. Thus, Ferguson has recorded the case of a woman, aged forty-three, who suffered for about a year from pain after food, vomiting, and hæmatemesis, and presented an ill-defined tumour in the epigastrium. After death the region of the lesser curvature of the stomach was found to be occupied by a large soft growth covered with excrescences, which extended a short distance up the œsophagus and had caused adhesions between the stomach and the under surface of the liver. Although microscopical investigation is said to have proved that the growth was a simple adenoma, the clinical aspect of the case and the naked-eye appearances of the disease clearly indicate that it was malignant in its nature. A similar criticism may be passed upon Lange's case, where a

deep ulcer on the anterior wall, surrounded by extensive infiltration, is said to have arisen from the disintegration of a simple adenoma, and as an example of such is usually cited.

(3) **Fibromata,** like the preceding variety, may be either single or multiple. They usually occur in the pyloric end of the stomach, and are often attached to the edge of the valve. As a rule they are elongated or club-shaped, and measure from one to four inches in length (Bernabei), but they sometimes assume a round or chestnut shape. The surface may be smooth, lobulated, warty, or distinctly villous, and the

FIG. 62.—Pedunculated fibroma attached to the edge of the pyloric orifice. (London Hospital Museum.)

pedicle is often of the same diameter as the tumour. Microscopically, they either present a papillomatous structure or consist entirely of fibrous tissue covered with thin mucous membrane.

(4) **Pedunculated Lipomata** are much rarer than the preceding varieties and are usually solitary. The growth is commonly situated in the central portion of the stomach and on the anterior wall, where it forms a soft lobulated tumour of a pale yellow colour with a short thick pedicle. In one of our cases the tumour measured two inches in length and two and a quarter inches in thickness; while in another it closely

resembled a thumb in size and shape. In rare instances a submucous lipoma passes through the muscular coat and forms a pendulous tumour of considerable size beneath the serous investment of the stomach (Orth, Russdorf). Microscopically it is found to consist of fat mixed with fibrous tissue and covered by thin mucous membrane.

(5) **Pedunculated Myomata** take the form of firm rounded tumours, which vary from the size of a pea to that of

FIG. 63.—A pedunculated fibroma with a long pedicle (natural size).

a cherry, and are attached to the wall of the stomach by a thin pedicle. They may be single or multiple, and are usually situated in the pyloric region. They consist of unstriped muscle-fibres, which are arranged in a concentric manner and covered by attenuated mucous membrane.

Symptoms.—The symptoms that accompany polypoid tumours of the stomach vary according to the size and situation of the growth. In nearly one half of the cases where the fundus or central portion of the viscus was affected by mucous

polypi, no symptoms whatever were observed during life, while in the rest the patients merely suffered from discomfort after meals, want of appetite, gradual loss of flesh, or from some other indication of disordered digestion. When, however, the pyloric region was involved by the disease, gastric phenomena were almost always present. As a rule the principal cause of complaint was epigastric pain, which was either persistent and unaffected by food, or was only experienced during the period of digestion. Less frequently the patient was subject to sudden and violent attacks, which persisted from a few minutes to several hours and were accompanied by retching and vomiting. In these latter cases there was usually a polypus of considerable length situated near the pylorus, the free extremity of which occasionally prolapsed through the valve and suffered temporary strangulation.

Case XXV. A man, fifty-seven years of age, complained for a long time of severe attacks of pain in the epigastrium, which were accompanied by nausea and vomiting. These symptoms occurred at irregular intervals some hours after a meal, and lasted from a few minutes to two or three hours. Each attack terminated suddenly and was followed by rumbling and gurgling over the site of the pain. The patient became very anæmic, and died from acute peritonitis. At the necropsy the stomach was found to be somewhat dilated, and a small perforation was present at the upper and anterior part of the pylorus. Three inches from the orifice, and attached to the lower border of the organ, there was a fibrous polypus as thick as the little finger and about three inches long. It seemed probable that the occasional entanglement of the tumour in the pyloric opening had occasioned the spasmodic pain and other symptoms observed during life.—*Cleghorn.*

In other cases periodic vomiting arising from obstruction of the pylorus is the principal feature of the complaint. In Cruveilhier's case the orifice was almost obliterated by the tumour and the stomach was greatly dilated, while in that recorded by Barr Stevens a dense mass of mucous polypi, covering an area three inches square, appeared to have acted as a ball-valve during life. In this instance the patient was the subject of epilepsy, and always experienced an aura referable to the stomach at the commencement of a fit. In one of our cases there was a long-standing complaint of flatulence and acidity, but owing to the incomplete nature of the obstruction vomit-

ing occurred only at intervals. Chemical examination of the ejecta does not afford any clue to the nature of the disease, but in the following case the diagnosis was easily made by the appearance of a detached polypus in the vomit.

Case XXVI. A female, aged nineteen, of robust appearance, had enjoyed good health until twelve months ago, when she had an attack of herpes zoster on the left side. A short time afterwards she began to suffer from distension of the stomach and pain after meals. At first the pain was only slight and occasional, but subsequently it became very bad, and was especially troublesome at night. For the last three months she had lost much flesh—a stone and a half in six weeks. She often felt faint with the pain in the stomach, which had also extended to the left side. The bowels were regular. One day, while going about her usual work, she suddenly felt faint and vomited a small tumour. At the time of its rejection another appeared to be rising in her throat, but she swallowed it again. After the emesis she felt poorly all day, and on several occasions ejected a small quantity of blood. The tumour itself was about the size of a chestnut, and appeared to have been attached by a small pedicle to the mucous membrane of the stomach. It was firm and looked like an unshelled egg. The cut surface showed several small foramina, and on microscopical examination it was found to consist of connective tissue, blood-vessels, and granular cells, covered by a layer of mucous membrane.—*Beardsley.*

Hæmorrhage occurs in about 10 per cent. of the cases. When it is due to excessive vascularity of the growth or of the surrounding mucous membrane, the vomit is merely tinged with blood, or exhibits a slight coffee-ground appearance; but when a large vessel has been eroded by ulceration or sloughing of the tumour the loss of blood may be serious and recurrent (Rondeau, Ellison).

Large adenomata are always accompanied by important gastric symptoms. If, as is usually the case, the tumour occupies the pyloric region of the stomach, pain after food, with flatulence, acidity, and vomiting, are the chief causes of complaint; and should the pyloric orifice ultimately become obstructed, periodic attacks of emesis, accompanied by loss of flesh, anorexia, and cachexia, gradually make their appearance, and, unless the disease proves amenable to treatment, eventually lead to a fatal issue. When the central portion or the fundus is the seat of the disease, there is usually severe pain after food;

vomiting and hæmatemesis, or melæna, occur from time to time, and the patient develops the emaciated and cachectic appearance which is usually indicative of a cancerous growth.

Case XXVII. A man, aged sixty-four, was admitted into hospital with the following history. Nine months previously he had begun to experience discomfort after meals with colicky pains and excessive flatulence. After continuing in this state for seven months he had been suddenly attacked by hæmatemesis, which lasted for two days. Since that time he had suffered severe pain after food, had lost his appetite, and had frequently vomited. He had also become much emaciated and very weak, and had noticed a tumour in the abdomen for nearly three months.

On examination the patient was found to be extremely thin and markedly cachectic. In the epigastrium a large tumour could be seen, which extended from the left costal margin to the right of the median line and downwards to the level of the umbilicus. On palpation it had a hard smooth surface, could be easily moved from side to side, and to a lesser degree in the vertical direction, and was resonant on percussion. No fluctuation could be detected in it, and manipulation gave rise to pain. There were no signs of dilatation of the stomach.

Cancer of the parietes of the stomach was diagnosed, and an operation was undertaken with a view to its removal. When the anterior wall of the organ had been incised, a large pedunculated tumour was found attached to the posterior surface. The pedicle was cut and the mass removed, the patient making an excellent recovery. The tumour itself was the size of the fœtal head at term, and presented a lobulated surface and a short thick stalk. The section showed numerous small cysts, and microscopical examination proved it to be a simple adenoma.—*Chaput.*

Duration and Complications.—Mucous polypi affecting the region of the great curvature do not appear to influence the duration of life, since in nearly one third of the recorded examples the patient attained the age of sixty years. In those cases, however, where urgent symptoms existed, or where the pedunculated tumour was of large size, the disease helped materially to shorten the period of existence. In most instances the fatal result was due to exhaustion arising from pain and vomiting. Fatal hæmorrhage has only once been recorded (Ellison), and the same remark applies to the frequency of perforation. The most important sequela is carcinoma. Lemaître has recorded a case in point, and Ménétrier has made some important observations upon the mode of development of the

malignant disease. In one case of multiple polypi which came under his notice a deep ulcer the size of a five-franc piece with an irregular pulpy base was found upon the lesser curvature. On microscopical examination the sides of the ulcer showed hypertrophied gland tissue similar to that in the polypi, but at the base the tubular processes, instead of being confined to the mucous membrane, were seen to have penetrated the muscularis mucosæ and to ramify in the submucous coat. The epithelium presented an atypical appearance, and secondary deposits of adeno-carcinoma were found in the lymphatic glands and in the liver. In another case, where the adenomatous disease occurred as a raised patch in the gastric wall (*en nappe*), the various gradations between simple adenoma and carcinoma could be easily traced. Spontaneous cure of the polypoid condition may be brought about by detachment of the growths (Beardsley), while a similar affection of the small intestine may lead to fatal intussusception, as in the following case :—

Case XXVIII. A man, aged twenty-one, was admitted into the Radcliffe Infirmary on June 28, 1895. His illness commenced about twelve months previously with pain across the upper part of the abdomen and vomiting. These symptoms had increased in severity during the last six months. On one or two occasions the vomit was blood-streaked. Pain did not seem to be affected by food.

On admission the patient looked anxious and very ill. Nothing was discovered in the abdomen to account for the pain and vomiting. While in the infirmary he vomited daily, and often complained of severe abdominal pain. Bowels confined. He was put on a fluid diet.

On the evening of July 10 the patient was seized with more than usually severe pain, and the vomiting became urgent. The following morning a distinct tumour could be made out, running obliquely across the abdomen from right to left. This was considered to be most probably an intussusception, and it was decided to open the abdomen. On this being done a large intussusception was found, commencing a few inches from the pylorus. It was easily reduced, but the patient's condition did not improve, and he died about twenty-four hours after the completion of the operation.

July 12.—On post-mortem examination an enormous number of polypi were found, varying in size from a pigeon's egg to a pea; they were scattered throughout the stomach and small intestines, the greatest number being in the duodenum and upper part of the jejunum. Many of them were furnished with long pedicles (fig. 61). *W. Collier.*

Diagnosis.—Multiple small polypi in the stomach, being rarely accompanied by any symptoms of importance, can seldom be recognised during life. In the only two cases where a successful diagnosis was made unmistakable evidence of the disease was afforded by the appearance of a polypus in the vomit. In Beardsley's case, already cited, the tumour was apparently detached during an attack of violent retching, while in the other it became entangled in the eye of a stomach-tube, and was thus removed (Debove). Even when the pylorus is partially obstructed no tumour can be detected, and the concomitant pain and hæmatemesis usually suggest the presence of an ulcer rather than of a growth.

Pedunculated adenomata accompanied by a palpable tumour are exceedingly rare, and closely resemble cancer or fibro-sarcoma of the stomach. Indeed, notwithstanding the cases of benign adenomata recorded by Chaput, Hinds, and others, we are strongly of the opinion that all palpable tumours occurring after middle life and accompanied by progressive symptoms are really malignant in character.

Treatment.—This resolves itself into the treatment of symptoms. If the stomach is dilated the employment of lavage with an appropriate diet will afford relief, while in cases where spasmodic pain is a prominent feature of the disease recourse must be had to opiates. The presence of a movable tumour connected with the stomach should be regarded as an indication for surgical interference.

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CHAPTER IV

SYPHILIS OF THE STOMACH

SYPHILIS may affect the stomach in three ways: (1) By the formation of gummata; (2) by the production of endarteritis; and (3) by exciting chronic inflammation of its mucous membrane.

(1) **Gummata.**—A gumma of sufficient size to attract attention is rarely encountered. Chiari observed only three instances in 243 necropsies upon persons suffering from syphilis, and in all about sixteen genuine examples are recorded in the literature of the subject. The tumour, which is often multiple, is usually situated in the submucous tissue of the pyloric region, near the lesser curvature. It is round and somewhat flattened on the surface, yellowish in colour, firm on section, and varies from three to seven centimètres or more in diameter. At first the mucous membrane which covers it is stretched and thin, but as the nodule increases in size and its substance undergoes softening it usually becomes destroyed and an ulcer is produced. A gummatous ulcer consequently presents certain features which serve to distinguish it from the simple variety. In shape it is often irregular, scalloped, or even triangular; its edges are thickened and undermined; while its walls and base are shaggy, cheesy, hæmorrhagic, or covered with a firmly adherent yellow slough. The mucous membrane in the vicinity of the neoplasm, or its resultant ulcer, exhibits signs of chronic inflammation and is not infrequently studded with minute gummata. Perforation of the stomach has not been observed, although in a case recorded by Lancereaux this accident was prevented only by the presence of a cheesy nodule. It is important to observe that in all these cases manifestations of syphilis were present in the other abdominal viscera, the liver, pancreas, spleen, or lymphatic glands pre-

senting gummata or cicatrices. In cases of congenital syphilis in newly born infants the small intestine is particularly apt to suffer, and small gummata may often be found scattered throughout its length or congregated about the ileo-cæcal valve. Similar conditions have also been described in the fœtus (Bittner).

(2) **Endarteritis.**—Obliterative endarteritis affecting the gastric vessels must not be regarded as necessarily an indication of syphilis. It may be observed in the fibrous base of nearly every chronic simple ulcer, and in not a few cases of long-standing perigastritis due to disease of some neighbouring organ. Its pathology is similar to that form of endarteritis which commonly accompanies cirrhosis of the lung and kidney, and in the case of a gastric ulcer its existence is of some value to the organism, since the gradual occlusion of the arteries which lie in the track of the advancing disease tends to prevent hæmorrhage. Syphilitic endarteritis, on the other hand, is comparatively rare as a primary complaint, and, as far as our experience goes, is always associated with gummata in the liver, spleen, pancreas, or retro-peritoneal glands. It chiefly affects the smaller branches of the pyloric vessels which ramify in the subserous and submucous connective tissue, and by thus diminishing the blood-supply to the part tends to induce inflammatory thickening of the mucous membrane and to give rise to interstitial hæmorrhages and superficial ulcerations. When the arterial disease is especially severe or widely diffused, the nutrition of the gastric wall is so much reduced that the tissues are no longer capable of withstanding the solvent action of the gastric secretion, which consequently erodes the surface and gradually produces an indolent form of ulceration. In other cases the partially obstructed vessel becomes the seat of thrombosis, and the mucous membrane which it supplies, being suddenly deprived of blood, is rapidly digested. In the former case the patient suffers from the symptoms of chronic ulcer of the stomach; in the latter, from attacks of acute dyspepsia, which are not infrequently followed by hæmatemesis.

(3) **Chronic Gastritis.**—This may ensue either as a direct or as an indirect result of syphilis. The latter variety is by far the more common, and is due either to embarrassment of the gastric circulation from disease of the liver or spleen, to lardaceous degeneration of the vessels of the stomach, to

secondary disease of the kidneys, or to the specific cachexia. This gastritis does not differ histologically from the ordinary varieties, and, like them, usually subsides when its exciting cause has been removed. Chronic inflammation of the stomach *directly* dependent upon the systemic infection occasionally results from repeated attacks of an acute character during the early phases of the complaint, such as have been described by Jullien and Fournier; but as a rule it appears only at an advanced stage of the disease, and is often associated with gummatous lesions of the bones, liver, or testes. To the naked eye the mucous membrane either is dull white and peculiarly opaque, or appears to be thickened and irregularly congested, with a surface like velvet pile. On microscopical examination the superficial roughness of the tissue is found to be due to an absence of the normal columnar epithelium and to a hyperplasia of the connective tissue between the mouths of the glands, which give the section the appearance of being covered with fine papillæ. The capillary vessels which ramify between the glands are dilated and filled with corpuscles; but here and there their outlines are obscured by an accumulation of the small round cells, which pervade the whole of the connective tissue and form thick layers around the mouths and fundi of the glands. The lymphoid follicles are enormously enlarged, and their cellular elements frequently penetrate the muscularis mucosæ and invade the submucosa. The gastric glands vary in appearance at different parts of the section, at one spot being comparatively healthy, while at another they are twisted, distorted, or disorganised by the round-cell infiltration. These general features are common to all forms of interstitial gastritis, from whatever cause they arise, but in the present case two special phenomena exist which indicate the syphilitic origin of the disease. The first of these takes the form of miliary granulations, which occupy the whole thickness of the mucosa and may even invade the submucous tissue or project slightly above the free surface. These nodules, which are really minute gummata, consist for the most part of a homogeneous granular non-staining material, and where several have coalesced a large portion of the section may consist entirely of this cheesy material. The other characteristic feature of a syphilitic gastritis is a hyperplasia of the inner coats of the small arterioles situated in the submucosa, which pro-

duces considerable narrowing of their lumina and not infrequently leads to thrombosis. These arterial changes may be observed in any part of the section, but are always most noticeable in the vicinity of the miliary gummata.

Symptomatology.—Chronic ulceration of the stomach due to syphilis is most common in men between twenty-five and forty years of age, in many of whom secondary symptoms of the infective disorder either have been very slight or were rapidly removed by treatment. The gastric complaint usually develops slowly, and for several months may be mistaken for some form of simple or inflammatory dyspepsia; but sooner or later the characteristic symptoms of ulcer show themselves and soon become severe. So far as our own experience goes, these cases chiefly differ from the simple variety of the disease in three particulars, the first of which is the extreme severity of the pain and vomiting, the second the infrequency of hæmorrhage, and the third their obstinacy to ordinary treatment and their great tendency to relapse.

Pain is invariably present, and, as is usual in gastric ulcer, is principally experienced in the epigastrium within half an hour after a meal containing solid food. In many instances, however, the suffering is almost constant, and even a diet of milk gives rise to oppression at the chest with distension and troublesome flatulence. When the disease has existed for some months the pain is often most intense during the night, when the stomach is devoid of food, and it may then extend all over the abdomen and chest and radiate down the extremities or up into the neck. Under these conditions the epigastrium is usually very tender, and the cranium, the tibiæ, and the heels may also be unduly sensitive to pressure. The attacks last for several hours, and are frequently accompanied by flatulent and acid eructations, burning in the throat, intense thirst, and vomiting. They are temporarily relieved by a draught of milk or a dose of bicarbonate of sodium, and more effectually by vomiting. Rosanow diagnosed a syphilitic ulcer in one patient on account of the nocturnal pain, and successfully treated it, while Bartumeus appears to lay stress upon attacks of emesis during the night; but since both these phenomena are met with in simple ulcer when complicated with hypersecretion, they cannot be regarded as pathognomonic of the specific form of the complaint. *Vomiting* is another con-

spicuous feature of the disease. At first the patient may be sick only during the painful crisis, which the act of emesis tends to curtail; but as soon as secondary gastritis develops vomiting may occur after every meal, while from time to time attacks come on which last for many days and prevent the administration of nourishment by the mouth. The constant pain and vomiting soon induce a serious deterioration of the general health. The patient becomes very thin and feeble, and presents the pinched and careworn look of one who is always suffering. The appetite may remain good, or even be excessive, but he is afraid to gratify the desire for food on account of the punishment which is sure to follow; while at intervals he is tormented by a thirst which no amount of water will subdue. The bowels are confined and the tongue is often covered with a white fur. The urine is diminished in amount and its reaction is often neutral or slightly alkaline, while in many cases it contains an excess of phosphates but is deficient in chlorides. Anæmia is invariably present, and the peculiar sallow complexion of many of the patients is very suggestive of a specific cachexia. Although nearly 70 per cent. of the cases of simple ulcer suffer from hæmatemesis, this symptom appears to be comparatively rare in the syphilitic disease, possibly on account of the gradual obliteration of the gastric vessels, which, as has already been pointed out, occurs in the vicinity of the sore. When, however, the portal circulation is embarrassed by coexisting disease of the liver or spleen, vomiting of blood may be an early and recurrent symptom.

As a rule the complaint fails to respond to the ordinary methods of treatment, and even when anti-syphilitic remedies are employed it may exhibit a great tendency to relapse. This latter peculiarity was very marked in the case of a woman who came under our care four or five times within two years for severe pain and vomiting after meals, accompanied by rapid emaciation. On each occasion the administration of mercury and iodides afforded almost immediate relief, and the disease appeared to be cured at the end of two months; but as soon as she discontinued the medicine, though persevering with a liquid diet, the pain recurred and she again lost flesh and vomited her food.

With regard to the chemistry of digestion there is very little evidence to offer. In the early stages of the complaint

free hydrochloric acid may usually be detected after a test meal, and in those cases where nocturnal attacks of pain are present the vomit usually contains an excess of the mineral acid. But when the disease has given rise to great loss of flesh and to debility we have never observed hyperchloracidity, but, on the contrary, have often found evidence of lactic acid fermentation. When vomiting is excessive the ejecta consist almost entirely of alkaline and bile-stained mucus. The usual cause of death is exhaustion from inanition, but an intercurrent affection like tuberculosis or some syphilitic complication often hastens the fatal termination. Hæmatemesis and perforation appear to be rare. Among the sequelæ of the disease, pyloric stenosis is the most important, and has been recorded by Cornil, Wagner, and Klebs.

Gastritis occurs both in hereditary and acquired syphilis, and is chiefly characterised by its chronicity and intractability to ordinary treatment. In infancy and early childhood the intestine usually suffers along with the stomach, so that in addition to the vomiting there is either diarrhœa or obstinate constipation. In all cases the loss of flesh, anæmia, and debility are out of proportion to the severity of the local symptoms, owing to the consecutive atrophy of the gastric and intestinal glands, which can be demonstrated in almost every case of so-called 'syphilitic marasmus.' During the period of childhood intercurrent attacks of acute gastritis, characterised by incessant nausea and vomiting, and occasionally by severe gastralgia, are apt to occur from time to time. The bowels are confined, the tongue is thickly coated, and slight delirium may appear at night. If no food can be retained in the stomach the disease may prove fatal; but as a rule the acute disease passes off in a few days, and is again replaced by the chronic form. In almost every instance the child presents evidences of syphilis in the face, teeth, and eyes, while not infrequently the development of a gumma heralds the onset of an acute attack. In one case which came under our care a large mass could be felt for several months in the liver, and subsequently a gummatous swelling appeared upon the forehead; while in one reported by Hemmeter the child presented an enormous gumma of the lower jaw.

Mild forms of syphilitic gastritis occurring in adult life are practically indistinguishable from the alcoholic variety, while in

the more severe cases the progressive loss of flesh, excessive debility, anorexia, and profound anæmia, coupled with an absence of free hydrochloric acid from the gastric contents, are highly suggestive of a malignant growth. More than one case of this description has come under our care in which, if it had not been for the routine trial of iodide of potassium, we should have diagnosed cancer of the stomach; and we have known several patients, who were condemned to carcinoma of the stomach or pancreas after an exploratory incision, who made a perfect recovery under anti-syphilitic treatment. Although traces of altered blood may appear in the vomit, severe hæmatemesis is rarely observed, unless the liver or spleen is also diseased.

Diagnosis.—In the diagnosis of syphilitic ulcer of the stomach two elementary principles should always be kept prominently in mind. In the first place, every gastric ulcer is not due to syphilis simply because the patient happens to have suffered at one time or other from that complaint. It must be remembered that probably about 5 per cent. of the population suffer from ulcer at some period of their existence, and, since syphilis is also by no means uncommon, it must necessarily happen that the two diseases will frequently be associated in the same individual, independently of any causal relationship between them. In 308 cases of chronic gastric ulcer of which we possess clinical notes a history of former syphilis existed in 10 per cent.; but in 132 cases of the disease which proved fatal, gummata or other evidences of syphilis were only observed after death in eight, or 6 per cent. We are, therefore, of opinion that only about 5 per cent. of all chronic ulcers of the stomach have any direct connection with syphilis, and that in the majority of these the connecting-link is to be found in arterial degeneration rather than in the formation of gummata.

The second point is this. Before it is accepted that the symptoms of gastric irritation in a syphilitic subject are due to the specific malady it must be clearly ascertained that they do not arise from injudicious medication. Many persons are very intolerant both of mercury and potassium iodide, and the prolonged administration of these drugs frequently gives rise to troublesome gastritis, accompanied by anæmia, loss of appetite, emaciation, and great debility. When these symptoms develop in a patient who has been under observation from the first, there is, of course, no difficulty in assigning the gastric disorder to its

proper cause, and in curing it by discontinuing the treatment. When, however, a patient of whom nothing is known, except that he has had syphilis, seeks advice on account of chronic gastritis, there is always a great temptation to overlook the possibility of toxic influences and to prescribe the same drugs which were originally responsible for the disease. A good instance of this recently came under our notice in the case of a woman who was sent to us with a diagnosis of cancer of the stomach on account of the pain after food, vomiting, and loss of flesh from which she had suffered for several months. We found upon inquiry that she had been under medical treatment for some time for an ulcer of the leg, and was inclined to attribute her indigestion to the pain and worry attendant upon that disease. As, however, she was obviously suffering from a gastritis of toxic origin, we preferred to take the view that the medicine, and not the sore on the leg, was the cause of the trouble, the assumption being that the former treatment had been directed against possible syphilis. Careful regulation of diet, combined with a rhubarb and bismuth mixture, afforded immediate relief, and within a month the patient reported herself as feeling perfectly well. It is therefore important to remember that gastritis occurring during the course of syphilis may result from injudicious treatment as well as from the disease itself.

Specific ulceration of the stomach has chiefly to be distinguished from the simple variety, from carcinoma, and from the gastric crises of locomotor ataxia. In every case of gastric ulcer the possibility of former syphilis should be borne in mind, and a search should be made for scars and other evidences of the disease. Excessive pain and vomiting, with great emaciation or profound anæmia, are always suspicious symptoms, while nocturnal attacks in which pain is felt in the long bones as well as in the abdomen are also suggestive of syphilis. The chief point of distinction, however, is the intractability of the disease to ordinary methods of treatment, while its symptoms rapidly subside on the administration of anti-syphilitic remedies. More than sixty years ago Andral diagnosed a syphilitic ulcer of the stomach from the fact that it was cured by the administration of mercury, and Galliard, Lancereaux, Wagner, Hayem, Rosanow, and Marc have all recorded instances in which the nature of the complaint was manifested in a similar manner.

The differential diagnosis of specific ulcer and cancer is often very difficult, especially when the former is accompanied by severe gastritis. In malignant disease, however, a tumour can usually be detected in connection with the stomach, the loss of flesh and strength is more rapid, nocturnal attacks of pain are infrequent, and the vomit often contains altered blood. The subjects of gastric cancer are also very intolerant of mercury and iodides, and after a few days' treatment with these drugs will usually volunteer the statement that the medicine is making them much worse. In the syphilitic affection, on the other hand, these remedies are the only ones which are found to afford relief.

The gastric crises of tabes occur at irregular intervals, and are seldom excited by the ingestion of food. There is little or no localised tenderness of the epigastrium, and the patient presents the usual signs of early ataxia. It is important to remember that syphilitic lesions of the central nervous system and of the stomach seldom, if ever, develop in the same individual.

The diagnosis of syphilitic gastritis is made by the absence of the usual conditions which excite inflammation of the stomach and by the discovery of a history or objective signs of syphilis. A few days' trial of iodide of potassium will usually suffice to clear up any doubt, since in ordinary cases of gastritis this drug greatly increases the dyspeptic symptoms, while the contrary result is observed in the specific disorder.

Treatment.—Absolute rest is essential, and much time will be saved if the patient is confined to bed for the first fortnight. Milk should form the staple diet for the first three or four weeks, but as it does not always agree so well as in simple ulcer it may be necessary to dilute it with soda-water or Vichy water. When vomiting is a troublesome symptom the milk should be peptonised. Clear soups, broths, jellies, and junket may also be allowed if the patient can take them without discomfort. After the first month, should the case be progressing favourably, milk puddings, soft bread and butter, eggs, tripe, and oysters may be permitted, and the diet may subsequently be increased by the addition of pounded fish, finely minced sweetbreads, and chicken cream. Meat and green vegetables should be prohibited for at least six months. If vomiting is troublesome, it may be necessary to feed the patient by the

rectum. When abdominal pain is severe the epigastrium may be constantly covered with a large linseed poultice, but as a rule the repeated application of a small blister is of greater value. With regard to medicinal treatment, it may be stated at once that mercury should always be combined with an iodide, since the latter is much less efficacious when given alone. In most instances it is sufficient to prescribe a mercurial pill of two grains, with an equal quantity of extract of hyoscyamus, night and morning, but in some cases drachm doses of the solution of perchloride of mercury are to be preferred. In young children inunctions of mercurial ointment or full doses of mercury and chalk are the most convenient methods of administering the drug. If there is any tendency to diarrhœa a small quantity of opium may be included in the prescription. The iodide of potassium or of sodium must be given in doses of from five to fifteen grains, and is most conveniently combined with carbonate of bismuth and liquid extract of sarsaparilla; while the addition of ten minims of glycerine of carbolic acid often tends to relieve the oppression and flatulence which are experienced after meals. Should the bowels remain constipated in spite of the mercurial, a teaspoonful or more of the artificial Carlsbad salts may be given each morning before breakfast. Lavage is chiefly indicated in the cases of chronic gastritis accompanied by troublesome vomiting, or where an ulcer has caused partial obstruction of the pylorus, but it should be avoided when symptoms of active ulceration are present. In every instance the patient should be warned of the tendency of the disease to relapse, lest he be tempted to discontinue the treatment as soon as the urgent symptoms have subsided.

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CHAPTER V

CONCRETIONS IN THE STOMACH

[Hair-balls—Bezoars—Gastroliths]

CERTAIN concretions are apt to form in the stomach, and to give rise to severe gastric symptoms attended by an abdominal tumour. As a rule they consist of hair, cotton, wool, tow or string, but occasionally they are composed entirely of vegetable matter, fibrous roots, or of resinous material.

(1) *Hair-balls* of sufficient size to attract attention are very rare, and we have beena ble to collect only twenty-four cases, the first of which was recorded by Baudamant in 1777.[1] When comparatively small the mass is round or oval in shape, and occupies the pyloric region, where it acts like a ball-valve; but as it increases in size it becomes moulded by the gastric contractions, until it forms a solid cast of the organ, and may even extend upwards into the œsophagus (Best) or through the pylorus into the jejunum (Gull, Pollock). It is smooth on the surface, compact and heavy, and consists of a vast number of hairs, varying from two to twelve inches in length, which are closely interwoven and agglutinated by mucus and food *débris*. In Gull's case the component hairs were of three colours, and could be recognised as belonging to the patient and her two children. Sometimes the hair is mixed with cotton, thread, or pieces of string. The largest concretion on record weighed 4lb. 7 oz. (Russell), and the smallest 5¾ oz. The habit of swallowing hair is not confined to the human subject, but is met with in the lower animals, and especially in cats, the Angora breed of which are said frequently to die from gastric concretions, owing to their habit of eating their fur when it is shed at certain periods of the year (Chepmell). Lunatics

[1] Schönborn states that in the year 1883 only seven cases had been recorded. He appears, however, to have overlooked English and American literature.

usually prefer harder substances, such as nails and crockery, but in a case recorded by Quain fatal perforation of the stomach was caused by a ball of cocoanut fibre weighing four pounds.

(2) *Concretions* composed of vegetable matter are occasionally found in the stomachs of persons who have consumed large quantities of fibrous roots or of other substances, owing to a perverted appetite or from a superstitious belief in their medicinal properties. Thus, in Kooyker's case a mass of starch and vegetable fibre weighing twenty-nine ounces was found in the stomach after death ; while in that recorded by Schreiber

FIG. 64.—A hair-ball (about one-half natural size).

the organ was completely filled by a mass of roots (Schwarzwurzel).

(3) *Stones or Gastroliths* are very rare, and we have been able to find only four authentic cases in the literature. They usually consist of shellac, which has been introduced into the stomach in the form of an alcoholic polish or varnish, and may be either single or multiple (Friedländer). As a rule they do not exceed three ounces in weight, but in the case related by Tidemand the mass weighed 1,500 grammes.

The local effects of the concretion consist of dilatation of the stomach with chronic inflammation and atrophy of its mucous membrane, while occasionally the organ becomes fixed by adhesions to the pancreas or abdominal wall (May). When the œsophagus or the duodenum is involved the orifices may be

greatly dilated. In more than one-half of the cases death occurred from perforation of the stomach in the pyloric region, or, as in those related by Gull and Yeo, from a similar lesion of the duodenum. Hæmatemesis was responsible for the fatal termination in one instance (Russell), and intestinal obstruction in several others (Ritchie, Friedländer). Occasionally the chronic irritation of the mass gives rise to superficial erosions, or even to papillomata (Best).

Symptoms.—The fact that various foreign bodies are frequently found in the alimentary tract of lunatics has given rise to the impression that gastric concretions occur only in persons of unsound mind. This belief is not only erroneous, but has been the cause of serious mistakes in diagnosis, for more than one writer has stated that, had he been aware that sane people were liable to the complaint, he might have suspected the nature of the abdominal tumour and have saved the patient's life by a timely operation.

(1) **Hair-balls.**—Out of the twenty-four cases of this variety no fewer than twenty-three were females, the youngest of whom was eighteen[1] and the oldest thirty-four at the time of death. There were never any indications of mental disease, and in several instances it was expressly mentioned that the patient was neither hysterical nor particularly emotional.

The habit of hair-swallowing is usually acquired in early life, when the hair is worn loose upon the shoulders. In the majority of cases it originates in the trick frequently practised by young girls of holding a lock of hair in the mouth while reading a book, or of biting the ends of a coil when angry or excited. In other instances it seems to arise from the inclination, which is so strongly marked in certain people, to fill the mouth with any substance with which they happen to be working, such as cotton in the case of dressmakers, wool or thread among weavers, and tow, flock, or cocoanut-fibre among those engaged in the manufacture of mattresses or mats. Finally, it may be due to some acquired eccentricity, of which the patient herself is often quite unconscious. Thus, in one case the husband stated that whenever his wife was unusually interested in a subject she invariably pulled out two or three hairs from the back of her head and put them into her mouth; while in

[1] Since this chapter was written Paton has reported the successful removal of a hair-ball from the stomach of a girl eight years of age.

another it was observed that the lady would frequently pluck hairs from her children's heads when she caressed them or played with them. In the instance recorded by Inman the patient was accustomed to clean her comb with her fingers, and quite unwittingly to put the little bunch of loose hair into her mouth instead of into a toilet tidy. In each of these conditions it is probable that the mouth and throat become so tolerant of the presence of the foreign substance that the hairs are constantly swallowed with the saliva without creating any unpleasant symptoms.

Until the concretion has attained a considerable size and has seriously diminished the capacity of the stomach it seldom produces any special symptoms, and even when the organ is completely filled with hair the patient may be quite free from pain and vomiting (Russell, Thornton). As a rule, however, after a prolonged period of more or less pronounced dyspepsia the patient begins to experience severe pain after meals with flatulence, distension, and nausea. Gradually the pain becomes localised to the epigastrium or left hypochondrium, and is increased by exercise or pressure upon the part. Vomiting is seldom absent, and sometimes occurs after every meal. The ejecta are small in quantity, acid in reaction, and often contain altered bile if the concretion involves the duodenum. Occasionally the vomit is stained with blood; but hair has never been observed in it. Anæmia is always a noticeable feature of the case, and may be accompanied by palpitation, dyspnœa, and œdema of the feet. The appetite is variable, but sometimes continues good; the tongue is foul, the breath offensive, and attacks of diarrhœa are apt to alternate with periods of troublesome constipation. Progressive loss of flesh is seldom observed except when vomiting is excessive.

Physical Signs.—In every case there is a well-marked abdominal tumour, which is often large enough to be visible through the parietes. When the concretion is comparatively small the tumour is globular in form and occupies the epigastrium, but in advanced cases it approximates closely to the shape of the stomach, and was variously described in the recorded cases as 'kidney-shaped,' 'crescentic,' or 'like a spleen.' As a rule it is situated in the epigastrium and left hypochondrium, but it may involve the umbilical and the left lumbar region. In Russell's case the stomach was so displaced that the pylorus lay in the

pelvis and the tumour occupied the whole of the left side of the abdomen.

On palpation it feels hard, smooth, and superficial, and has a well-defined lower border. It is dull on percussion and seldom tender, except after prolonged manipulation and in those cases where the stomach is ulcerated. One of the principal features of the tumour is its extreme mobility, which permits it to be displaced downwards and to the left, or to be pushed upwards beneath the costal margin in the direction of the spleen. At a late stage of the complaint, however, adhesions may form, which fix the organ to the pancreas or abdominal wall

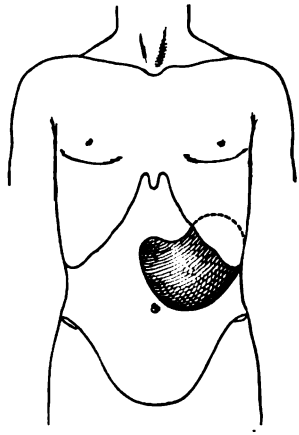

FIG. 65.—Tumour formed by a hair-ball in the stomach.

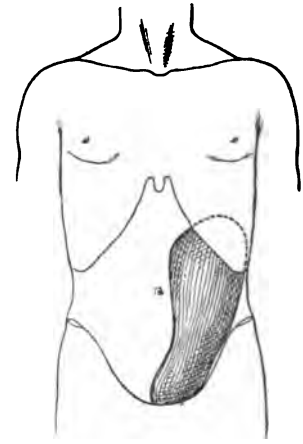

FIG. 66.—Tumour formed by a large hair-ball which had produced dislocation of the stomach.

(May). Peristaltic movements of the stomach are rarely visible, but flatus may sometimes be seen or felt in the tumour (Best). Sometimes other hard, globular, and movable masses may be detected to the right of the navel or in the iliac fossa from the presence of hair-balls in the duodenum or ileum. In every case the tumour enlarges very slowly, and, except perhaps for a sensation of weight or dragging, it does not give rise to any special inconvenience.

Duration and Complications.—The duration of the disease is difficult to determine, but it probably averages about fifteen years. In May's case the patient was known to have practised hair-swallowing for twenty-two years, and in that recorded by

Russell the tumour had been detected at the age of fourteen. From its slow growth during adult life it is probable that the greater part of the concretion is formed during childhood. With the exception of two instances in which laparotomy was performed, all the cases ended fatally. In about one half death was due to ulceration and perforation of the stomach; fatal hæmatemesis occurred in one instance, while in two others intestinal obstruction was responsible for the lethal event. In all the rest death ensued from exhaustion entailed by vomiting and diarrhœa.

Case XXIX. A girl, eighteen years of age, had suffered for some time from pain and vomiting after food, a capricious appetite, and looseness of the bowels. In the epigastrium there was a tumour about the size of an orange, globular in shape, somewhat movable, and of very slow growth. The patient suddenly became collapsed, and died of peritonitis. At the necropsy the stomach was found to be filled by a mass of hair and string, which was moulded to the shape of the organ and measured six inches long, three and three-quarter inches in width, and two and a half inches in thickness. A second cylindrical mass measuring fourteen inches in length filled the duodenum and extended into the jejunum. A chronic ulcer of the stomach had perforated into the peritoneal cavity.—*Pollock.*

Case XXX. A lady; thirty-one years of age, was suddenly seized with severe hæmatemesis. She had not suffered from any gastric symptoms previously, but was known to have had an abdominal tumour since the age of fourteen. The tumour now occupied the whole of the left side of the abdomen and extended from beneath the left costal margin to the pelvis. It moved with respiration, was dull on percussion, and had a hard smooth surface. The inner border was slightly concave, well defined, and apparently presented a notch about its centre. It resembled a spleen in every particular, with the possible exception that its length was somewhat out of proportion to its width. The hæmorrhage proved fatal. A necropsy showed that the tumour was composed of the stomach, which was almost vertical in position, with the pylorus in the cavity of the pelvis. Its contents consisted of a firm mass of hair measuring twelve inches in length, five in width, and four in thickness, and weighing 4 lb. 7 oz. The individual hairs were of all lengths up to twenty inches. The mucous membrane near the great curvature was ulcerated, and the pylorus was dilated to about four times its normal size. The lady's husband stated that whenever his wife became excited she was in the habit of pulling two or three hairs from her head and putting them into her mouth.—*Russell.*

Case XXXI. A factory-girl, aged twenty-one years, was admitted into hospital with the symptoms of acute intestinal obstruction. A large movable tumour could be felt in the epigastrium. After death the stomach was found to contain a mass of hair weighing twenty-one ounces, which had produced extensive ulceration of the viscus. The ileum was ruptured just above the cæcum, and on either side of the lesion there was a ball of hair, the larger of which weighed one and a half ounces and had obstructed the intestine at the ileo-cæcal valve.—*Ritchie.*

Case XXXII. A girl fifteen years of age came under treatment for an abdominal tumour. For three years she had suffered from severe pain and vomiting after food. The tumour, which occupied the epigastrium and left hypochondrium, felt like a large kidney with the hilus upwards and to the right. It was hard, freely movable, dull on percussion, and somewhat tender. An exploratory operation proved that it was contained in the stomach, and when the organ was incised a large mass of hair was found and removed. After the patient had recovered it was ascertained that for at least four years she had been accustomed to swallow hair in order to improve her voice.—*Schönborn.*

(2) **Vegetable Tumours.**—These are even rarer than the preceding, and consist of undigested vegetable material, fruit skins, cherry stalks, or the fibrous roots of certain plants which had been swallowed on account of their reputed medicinal virtues.

Except that they occur at a somewhat later period of life, the symptoms are similar to those already noted. For several years there is complaint of pain and vomiting after food, with loss of appetite, emaciation, and an irregular action of the bowels. Occasionally hæmatemesis and cachexia are also observed. The tumour is seldom as large as a hair-ball, and is usually globular in shape and situated in the epigastrium. As a rule death ensues from perforation of the stomach, hæmorrhage, or exhaustion, but occasionally the foreign body undergoes disintegration and is either vomited or evacuated by the bowel.

Case XXXIII. An individual, fifty-two years of age, came under medical treatment for severe pain and vomiting after food, with progressive loss of flesh. Hæmatemesis had occurred at intervals, and there was marked cachexia. In the epigastrium a round tumour the size of a small apple could be felt, which was dull on percussion, movable, and slightly tender. The diagnosis was obscure, and opinions varied between enlarged spleen, a floating kidney,

and malignant disease of the stomach or transverse colon. Death occurred from exhaustion at the end of three years. At the necropsy the tumour was found to be within the stomach, and to consist of a kidney-shaped mass of vegetable matter weighing twenty-nine ounces, with two other masses, each about the size of a hen's egg.—*Kooyker.*

Case XXXIV. A woman, aged forty-three years, complained of violent pain in the abdomen after meals, vomiting, and constipation. Under the ensiform cartilage a hard fixed and tender tumour could be felt. After these symptoms had existed for a considerable time an exceptionally violent fit of vomiting caused the expulsion of a large sodden mass of vegetable matter, after which the patient made a good recovery.—*Capelle.*

Case XXXV. A woman, forty-five years of age, was admitted into hospital for an abdominal tumour accompanied by pain and vomiting. The tumour resembled a large spleen, but as it was ascertained that the patient had eaten a quantity of a plant which superstition endowed with marvellous powers of healing, a diagnosis of phytobezoar was made, and a large mass of fibrous roots was successfully removed from the stomach by operation.—*Schreiber and Eiselsberg.*

(3) **Gastroliths.**—The subjects of this curious complaint are usually men about middle age who, in their morbid desire for alcohol, frequently have drunk varnish, polish, or similar liquids containing it. As a rule the stone is too small to be detected during life, but in the case recorded by Tidemand a large hard tumour could be felt in the epigastrium. Symptoms of gastric irritation with vomiting are almost always present, and hæmatemesis is sometimes observed. Death ensues from exhaustion, perforation of the stomach, or from intestinal obstruction (Friedländer, Langenbuch).

Case XXXVI. A polisher, forty-four years of age, was admitted into hospital with the symptoms of chronic gastritis. He was extremely intemperate in his habits, and the gastric disorder was consequently attributed to chronic alcoholism. After the lapse of some months he succumbed to pulmonary tuberculosis. At the necropsy a chronic ulcer was found in the stomach near the pylorus, and close to it an oblong mass of stone which measured ten centimetres in length and five in width, and weighed seventy-five grammes. Chemical examination showed the concretion to be composed of shellac, and it was afterwards ascertained that the man had been accustomed to drink the polish he used in his work, which consisted of shellac dissolved in alcohol.—*Manasse.*

Diagnosis.—It is probable that small concretions not infrequently occur in young girls who bite or suck their hair; but when the habit is discontinued, as it usually is after the hair has been dressed in the adult style, the material is gradually evacuated without the production of serious consequences. In one very obstinate case of dyspepsia which came under our notice the sides of the forehead had been quite denuded of hair by this pernicious habit, and it was only after the dangers attending a hair-tumour had been explained to the young lady, and measures adopted to prevent a repetition of the practice, that the gastric complaint gradually disappeared. It is, therefore, advisable that in every case of obstinate dyspepsia in a girl careful inquiries should be instituted with regard to her habits and occupations, and that, whenever an abdominal tumour is discovered in a young adult, the possibility of a foreign body in the stomach should be borne in mind.

If pain and vomiting are prominent features of the case, the discovery of a tumour in the abdomen is usually suggestive of malignant disease of the stomach or intestine. In such cases three points deserve special attention, namely, the age and sex of the patient, the duration of the complaint, and the character of the tumour. Cancer of the stomach is very rare before the age of thirty, and its precocious development is chiefly met with in men, while hair-tumours commence at or before puberty and are practically confined to women. The malignant disease is seldom preceded by symptoms of indigestion, and usually runs such a rapid course in young persons that life is destroyed within seven months; gastric concretions, on the other hand, are usually attended for a long time by pain and sickness after meals, and seldom prove fatal in less than ten years. Lastly, a cancerous tumour is irregular, nodular, tender, more or less fixed in position, and of rapid growth, while in most instances the stomach is dilated, marked cachexia is present, and the gastric contents are devoid of free hydrochloric acid. A hair-tumour, on the other hand, is globular or crescentic in shape, situated principally in the left side of the abdomen, is smooth, hard, and painless on palpation, and so freely movable that it may be pushed under the left costal margin. There is no ascites or jaundice, the outlines of the stomach are indistinguishable from those of the tumour, and a tube cannot be inserted more than two inches into the viscus.

A painless tumour in the upper part of the abdomen, which is not attended by special symptoms and has been discovered in an accidental manner, is most likely to be confused with an enlarged spleen, a floating kidney, or a fæcal accumulation in the colon.

If the stomach happens to be dislocated, as in Russell's case (fig. 66), the diagnosis from an enlarged spleen is extremely difficult. It may usually be observed, however, that the tumour is exceptionally movable, and that its length is out of proportion to its breadth. The inner margin is less distinct than in the case of a spleen, the characteristic notch is absent, and the passage of a soft tube or inflation of the stomach will at once show that the tumour is gastric in origin. A loose kidney on the left side can usually be displaced downwards as well as upwards, and its point of attachment is much lower than that of an enlarged stomach. It also lies behind the intestine, so that the percussion-note is resonant rather than dull, and manipulation is often attended by pain. In case of doubt, inflation of the stomach should be practised, when the relation of that organ to the tumour can easily be ascertained.

A fæcal mass in the colon is more irregular in shape and less definite in outline than a gastric concretion. It is less hard to the touch, and may even be soft enough to indent with the finger, while other tumours of a similar character may be found in the cæcum, sigmoid flexure, or rectum. The passage of a tube shows that the stomach is empty and situated above the tumour, and the administration of several large enemata will either diminish the size of the mass or remove it altogether.

Treatment.—If the tumour is small in size, it may be possible to secure its evacuation by an emetic; but this method is always fraught with a certain amount of danger, on account of the ulceration of the stomach which is often present. In the case of large tumours medicinal remedies are valueless, and recourse must be had to an operation. In the cases reported by Knowsley Thornton and Schönborn the mass was successfully removed after the nature of the tumour had been determined by an exploratory incision, while in that recorded by Schreiber a correct diagnosis of phytobezoar was made by the physician and the concretion extracted.

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CHAPTER VI

CYSTS OF THE STOMACH

CHRONIC inflammation of the stomach is occasionally accompanied by the formation of numerous cysts about the size of hempseeds, which project above the surface of the mucous membrane and are filled with a clear fluid. This condition results from obstruction of the mouths of the ducts, and the consequent retention of the gastric secretion within the tubular glands. It does not possess any clinical significance (Handfield-Jones, Harris).

Solitary cysts of the stomach are very rare, and we have been able to find only fourteen cases recorded in the literature, to which we have added one of our own. They vary in size from a pigeon's egg to a cocoa-nut, and their contents usually consist of altered blood or of a pinkish fluid containing crystals of cholesterine. As a rule they form in the subserous tissue of the posterior wall or upper margin of the organ, but occasionally they develop in the submucous coat. In the former case the cyst appears to be external to the stomach, and exerts deleterious pressure upon the surrounding viscera; while in the latter it may partially occlude the lumen of the organ or, by perforating the muscular tunic, project externally as well as beneath the mucous membrane. The cases at our disposal afford examples of seven varieties of cystic disease.

(1) **Dermoid Cyst.**—The sole example of this rare affection was recorded by Ruysch in the year 1732. It consisted of a small tumour of the gastric wall which contained hair.

(2) **Serous Cysts.**—These usually develop between the muscular and serous coats of the stomach on the anterior surface or near the upper margin. In the case described by Albers the tumour occupied the lesser curvature, and measured two and a quarter inches in length. Occasionally they become pedunculated, and sometimes muscular tissue is found in their walls.

Case XXXVII. A man, aged twenty-one, succumbed to concussion of the brain. Attached to the cardiac end of the stomach, just below the diaphragm, there was a cyst the size of a pigeon's egg. Microscopical examination showed the wall of the cyst to be composed of unstriped muscular tissue, which was arranged in two longitudinal layers with a transverse one interposed between them. The wall was well supplied with blood-vessels, and much blood was effused between the muscle-bundles. The cyst was lined by a single layer of stumpy epithelioid cells, some of which were cuboidal.—*Hebb.*

Case XXXVIII. A woman died at the age of thirty years from cancer of the pylorus with secondary deposits in the liver. During life a smooth and very movable tumour was detected in the epigastrium. After death, in addition to the cancerous disease, there was found a cyst about the size of the fœtal head at term, which was attached by a short pedicle to the pyloric end of the stomach, and was filled with a reddish fluid.—*Finnel.*

(3) **Hydatid Cysts.**—These are represented by two examples. In the one described by Bochlendorff the tumour originated in the vicinity of the stomach, and involved the viscus during the course of its development, while in that recorded by Castellvi y Pallarés the gastric wall seems to have been primarily affected.

(4) **Blood Cysts.**—Our series contains four instances of this variety. In three cases the tumour was of large size, and its contents consisted of coffee- or chocolate-coloured fluid containing a large quantity of mucus, blood-corpuscles, and pus cells; while in the fourth the nature of the cyst was less definite, but the pinkish colour of its contents and the presence of cholesterine crystals seemed to indicate a hæmorrhagic origin.

Case XXXIX. A man, aged thirty-eight years, had suffered for five years with pain and sickness after food. At first these symptoms had been intermittent, but for six months the pain had been more or less constant, and vomiting had occurred regularly from half an hour to an hour and a half after meals. When admitted into hospital he was very emaciated and vomited three times a day. There was no cachexia and the appetite continued good. The stomach was dilated and its lower border extended below the level of the navel. Four litres of fluid were removed by means of a soft tube, and the regular employment of lavage greatly relieved the symptoms. A sense of resistance could be detected on palpation of the epigastrium, which was thought to be the left lobe of the liver. Three months later an ill-defined rounded tumour could be felt in the epigastrium and right

hypochondrium. As fluctuation was present it was regarded as a hydatid cyst of the liver, and aspirated, with the result that 950 grammes of a mucoid bilious fluid were withdrawn. A month afterwards the cyst had regained its former size, and when punctured once more 700 grammes of brownish fluid were evacuated. The relief afforded by the operation was only temporary, since the abdominal pain and sickness soon returned and about the tenth day jaundice set in. At the end of three weeks the tumour was again prominent, and a trocar was inserted for the third time, with relief to the jaundice. After an interval of another three weeks, during which the icterus returned, a fourth aspiration withdrew 900 c.c. of a chocolate-coloured fluid containing pus. Although the jaundice disappeared and the patient felt much relieved, it was felt necessary to drain the cyst in a more efficient manner. Unfortunately general peritonitis was set up by the escape of some of the contents of the tumour during the operation, and the patient died.

Necropsy.—The stomach was much dilated, and the pylorus was compressed by a large cyst connected with the lesser curvature and extending into the lesser cavity of the peritoneum. The cyst did not communicate with the stomach, but opened into a small cavity situated in the muscular coat of the viscus at the pylorus. The contents consisted of altered blood, mucus, and a little pus, and the icterus was found to have arisen from the pressure of the sac upon the gall-bladder and bile-duct at the hilus of the liver. The lining membrane of the cyst was extremely vascular.—*Rendu.*

Case XL. A female, twenty-two years of age, was suddenly seized with severe pain in the left side of the abdomen, which was increased by inspiration. The bowels were obstinately confined. After a week in bed the pain was relieved but never quite disappeared, and vomiting occurred occasionally. Soon afterwards the patient noticed a small tumour in the left hypochondrium, which gradually increased in size and gave rise to excruciating pain. As the tumour appeared to be cystic, it was punctured, and a quantity of clear albuminous fluid was withdrawn, after which the pain disappeared and the tumour could hardly be detected. About a fortnight later, however, the pain returned, and the tumour was found to have regained its former dimensions. A second puncture resulted in the evacuation of a similar quantity of fluid, but the cyst filled up again in a couple of weeks. At this period it was noted that the abdomen was enlarged and the tumour occupied the left hypochondriac, umbilical, and left lumbar regions, extending from the margin of the ribs to the level of the iliac crest and to the right of the median line of the belly. The surface was smooth, the percussion-note was dull, and stomach resonance could be detected between the tumour and the diaphragm. Distinct fluctuation was perceptible. Two months later the patient

was readmitted into hospital with the symptoms and signs of acute phthisis, but she still complained of pain in the tumour, which, however, did not appear to have increased in size. Death occurred from acute peritonitis about fourteen months after the first symptoms of the abdominal complaint had appeared. At the necropsy a cyst the size of the fœtal head at term was found connected with the posterior wall of the stomach. Rupture of its wall had set up fatal peritonitis.—*Gallois, Honlang, and Leflaive.*

Case XLI. A middle-aged woman had suffered for a few months from vomiting, pain in the abdomen, and loss of flesh. Examination showed a large tumour in the umbilical region and left hypochondrium, which was somewhat movable, smooth, non-tender, dull on percussion, and cystic in character. When the abdomen was opened the cyst was found to be connected with the anterior wall of the stomach, and to contain a reddish-brown fluid with crystals of cholesterine. After death another large cyst was discovered between the serous and muscular coats of the organ, on the posterior surface, and two others existed in the wall of the jejunum.—*Anderson.*

Case XLII. A man aged thirty-three died of enteric fever. In the wall of the stomach, close to the pyloric orifice, there was a cystic tumour the size and shape of a walnut. The tumour projected both externally beneath the peritoneum and internally beneath the mucous membrane, having perforated the muscular coat of the organ. It thus possessed the shape of an hour-glass. Internally its size was sufficient to completely occlude, as a valve, the pyloric orifice; but by pressure the fluid might be emptied into the subperitoneal half of the cyst, when the mucous membrane would hang loose. With the finger the constricted orifice of communication between the two halves of the cyst might easily be felt. There were no signs of inflammation about the cyst, nor were its mucous or serous investments at all thickened. When opened the cyst was found to contain about half an ounce of an opaque pinkish fluid, glittering with plates of cholesterine. No signs of hydatid could be detected.—*Sloane, reported by Hutchinson.*

In the following case a blow on the abdomen appears to have been the cause of the disease:

Case XLIII. A man, aged twenty-three, received a severe crush in the upper part of the abdomen, which rendered him unconscious. When he revived he complained of great pain in the left side of the chest and abdomen and expectorated a little blood. The abdomen was found to be distended and very tender upon pressure, but no tumour could be detected. The urine was blood-stained, and subsequently the stools contained altered blood. There was slight pyrexia

for three days. On the sixth day after the accident these various symptoms had subsided and the patient appeared to be quite well. During the third week, however, considerable pain was experienced in the left side of the abdomen, and a tumour about the size of an apple, elastic and slightly pulsatile, was felt in the affected region. Vomiting now took place each night, the pain increased, and the tumour rapidly enlarged and extended to the right of the median line. Finally symptoms of intestinal obstruction appeared, vomiting was urgent, and the abdomen became distended. On puncturing the tumour three quarters of a litre of a gummy fluid containing altered blood was withdrawn, after which the mass disappeared and the abdominal symptoms subsided. After a short interval the tumour reappeared and the pain and vomiting returned. The appetite, however, remained good and there was no pyrexia. In the left hypochondrium, between the navel and the ribs, a large elastic swelling could be felt, the outline of which was fairly defined below and to the right but indistinct above. The tumour was dull on percussion, fixed, and apparently lay above the transverse colon. An exploratory operation was determined upon, and when the belly was opened the tumour was found to be a large cyst situated in the anterior wall of the stomach and beneath its serous coat. There were no adhesions. The wall of the cyst was two or three centimetres in thickness, and it contained three litres of black blood. Drainage was effected and complete recovery ensued.—*Ziegler.*

(5) **Lymphangioma, or Chylous Cyst,** has been described by Engel-Reimers. The patient was a man about fifty years of age, who succumbed to hæmatemesis. After death an ulcer was found upon the posterior surface of the stomach, which was adherent to the pancreas. The lesser curvature was greatly contracted, and upon the outer surface there was a soft hemispherical swelling, covered by peritoneum, which contained a milky fluid. The contraction of the upper border of the stomach had probably obstructed some of the lymphatic trunks which traverse the subperitoneal tissue in that region of the organ.

(6) **Cysts from New Growths.**—These are usually too small to be recognised during life. Billroth, however, has recorded an instance in which an enormous cyst of the stomach ensued from the degeneration of a sarcoma, while in the following case the primary disease appears to have been a submucous lipoma:

Case XLIV. A man, aged sixty-two, when apparently in good health, was seized with violent pain in the right side of the belly and

vomiting. These symptoms continued and slight jaundice developed. Three days later the vomit resembled coffee-grounds and the temperature rose to 101°. At the end of the week the pyrexia disappeared and the patient seemed much better. Three weeks after the commencement of the illness, however, he again vomited altered blood, and complained of pain and tenderness at the epigastrium. He died of exhaustion a fortnight later.

Necropsy. 'The stomach appeared to be enormously dilated, and in endeavouring to remove it it was ruptured in two or three places, and fully a quart of grey grumous fluid escaped. After tying the duodenum and œsophagus and removing the entire mass, it was found that we had really ruptured a cyst which completely enveloped the stomach, extending from the liver on the right to the spleen on the left, and closely adherent to both. It surrounded the common bile-duct, which was dilated to the size of the little finger, descended to the lower end of the vertical portion of the duodenum, and enfolded the whole of the great curvature of the stomach, forming adhesions with everything with which it came in contact. Besides the escaped fluid it contained numerous lumps of a fatty substance of the size of cardamom seeds, and loosely attached to its walls were masses of these fatty lumps, aggregated together, with black streaks intermingled. These latter were the remains of extravasated blood. The stomach showed a punched-out ulcer the size of a thumb-nail, with the open mouth of a small blood-vessel in its edge. Around it for some distance the mucous membrane was congested and covered with bleeding points. Only a thin layer of connective tissue intervened between the bottom of the ulcer and the cyst.'—*H. H. Read.*

In the next case the nature of the cyst was indefinite, but from the statements regarding a 'fibrous reticulum' and 'lymph-angiomatous structure' it was possibly due to the degeneration of a growth:

Case XLV. A woman, aged twenty-two, was admitted into the London Hospital for pain and swelling of the abdomen. The umbilical and hypogastric regions were occupied by a large tumour, which could be moved slightly in a lateral direction and also descended on inspiration. It was painless, dull on percussion, and felt like a tense cyst. The opinion being that the tumour was a cyst of the ovary, an operation was undertaken for its removal; but when the belly was opened the cyst was found to be attached to the lower border of the stomach. A portion of it was removed, but the patient died of peritonitis.

Necropsy. 'On the peritoneal surface of the posterior wall of the stomach, about two inches from the pylorus, are the remains of a large

cyst, the greater part of which was removed during life. This cyst, which has a smooth lining membrane, is separated from the gastric wall by a smaller cyst, of the size of a turkey's egg, which forms a peduncle to it. The cavity of the smaller cyst, which communicates by a wide aperture with the larger one, is partly occupied by a fibrous trabecular structure. Close to the pylorus, and in the lesser curvature, are two cysts similar to the last, connected with the serous surface; one is about the size of a pigeon's egg, and the other twice as big. They contained serous fluid with some dark material. At

FIG. 67.—Portion of a stomach showing an enormous dependent cyst growing from the posterior wall. (London Hospital Museum.)

this part also there are some irregularly lobulated prominences of the mucous surface, one as large as half an orange; and somewhat further from the pylorus, on the posterior wall, is a second projection of the mucous surface, similar to the first, but smaller, the two being separated by a level piece where the large cyst is connected with the gastric wall. In the smaller elevation there is an opening at one point, where the wall of a cavity has been opened by ulceration, through which a delicate and open-meshed fibrous reticulum of degenerated growth projects. Arising from the peritoneal surface at

this part is what looks like a mass of adipose tissue the size of an egg. Sections from it show spaces of varying size in a fibrous reticulum resembling a lymphangioma, and some larger cysts. The black pulpy substance in the cyst contained variously shaped cells, some granular matter and fat.'

Symptoms and Physical Signs.—The clinical aspect of the disease varies according to the size and position of the cyst. When it is small or attached to the cardiac end of the stomach it usually escapes detection, and is only discovered after death (Ruysch, Engel-Reimers, Hebb); and even in Sloane's case, where it was proved to be capable of obstructing the pylorus, no indication of its presence had been forthcoming during life. The larger varieties, on the other hand, are always attended by urgent gastric symptoms, and not infrequently by others which arise from pressure upon neighbouring viscera.

When the disease is due to injury or to extravasation of blood into the substance of a benign tumour (Ziegler, Read), the complaint may commence abruptly with violent pain, vomiting, and collapse; but as a rule discomfort in the abdomen, occasional sickness and constipation are the first symptoms to attract attention (Rendu, Gallois). Gradually the pain increases in severity, and becomes localised to the epigastrium or to one hypochondrium, vomiting occurs after meals, and the patient loses flesh and strength. Sometimes the pain is paroxysmal in character and appears to radiate from the tumour, which becomes exquisitely tender; or it may be only when the patient walks about or stoops that he experiences any discomfort. The tongue is often furred and the bowels confined, but it is noticeable that the appetite usually continues good and there is neither elevation of temperature nor cachexia. In the early stages of the complaint examination of the abdomen may reveal only a little fulness or slight resistance in the epigastrium, but as the cyst increases in size it gives rise to an ill-defined smooth tumour, which encroaches upon one or other hypochondrium. There may be some mobility with respiration, but unless the cyst is pedunculated, as in Finnel's case, it usually appears to be attached to one of the solid organs in its vicinity. At this stage it is almost always possible to detect fluctuation in the tumour, or else the elastic sensation it communicates to the fingers clearly indicates that it contains fluid. Exploration with a hollow needle or trocar was performed in

three cases, with the result that from half a pint to two pints of thick grumous fluid were withdrawn. The operation was followed by a disappearance of the tumour, with relief of the symptoms for about ten days, after which time the cyst again filled up and the pain and vomiting returned. The principal complications of the disease are due to the pressure it exerts upon the surrounding structures. When the cyst extends to the right of the median line of the abdomen, it may compress the pylorus or the duodenum and give rise to dilatation of the stomach (Rendu), or it may occlude the bile-duct or the portal vein and lead to jaundice or ascites. Unless subjected to surgical treatment, large cysts of the stomach usually end fatally, either from general exhaustion, spontaneous rupture, and peritonitis, or from the effects of pressure upon the bile-duct or portal vein.

Diagnosis.—Small tense cysts attached to the outer wall of the stomach are difficult to distinguish from solid tumours. In the case of large cysts, the presence of fluctuation indicates at once that the tumour contains fluid, and the chief difficulty is to determine the organ that is involved. The extreme rarity of a cyst of the gastric wall naturally predisposes to the view that some other viscus is affected, and accordingly we find that in the recorded cases the diagnosis varied between a cyst or abscess of the liver, spleen, kidney, pancreas, or mesentery, while in one instance cancer of the stomach was suspected.

A cyst of the liver is almost always a hydatid, and is seldom attended by any particular symptoms until it has reached a considerable size or has exerted pressure upon some external structure. It usually forms a rounded, elastic, non-tender tumour, which moves with respiration and cannot be distinguished from the liver by palpation or percussion. A gastric cyst, on the other hand, is accompanied by severe pain and vomiting, is less indistinct in outline, and is often separated from the lower border of the liver by an area of resonance.

The absence of fever and the very slow growth serve to distinguish a cyst from an abscess. A cyst of the spleen appears to spring from the left hypochondrium. It is painless, clearly defined, dull on percussion, and moves readily with respiration. As a rule the edge of the spleen can be felt either above or below the margin of the tumour. A cyst of the kidney or a hydronephrosis is situated in the loin rather than

in the epigastrium or hypochondrium, and forms a well-defined tumour, which can be grasped between the hands. It is resonant on light percussion, immovable on respiration, and there is usually a history of renal colic or hæmaturia, with a diminished secretion of urine. A cyst of the pancreas is situated in the median line, and may be attended by severe pain in the back and vomiting. At first it is covered by the stomach and colon, but as it comes forward it may stretch the gastro-colic omentum and present a dull note on percussion. It is fixed, non-tender, and may usually be distinguished from the stomach by inflating the latter organ with air or gas. A cyst of the mesentery, such as has been described by Hahn, is more movable than the gastric affection, more distinct in outline, and an area of resonance often intervenes between the tumour and the stomach.

Encysted collections of fluid situated between the layers of the great omentum or in the lesser cavity of the peritoneum occasionally give rise to tumours which in their symptoms and physical signs closely resemble cysts of the gastric wall. Two cases of this description have come under our notice, the first of which consisted of a hydatid attached to the posterior aspect of the stomach, and the second of a cyst of hæmorrhagic origin.

Case XLVI. A middle-aged woman was sent to us by Dr. Latham, of Barnsbury, suffering from tumour in the abdomen. It appeared from her history that she had been in good health until about four months previously, when she began to experience severe attacks of pain in the abdomen, followed by vomiting. The appetite remained good, and there was no bleeding from the stomach, but she lost much flesh and grew very weak. About a month before we saw her she noticed that her abdomen was swelling. There was no family history of importance, nor had the patient suffered from an injury. On examination she was found to be very thin, but not anæmic. The upper half of the abdomen was distended, and on palpation a rounded tumour of somewhat indefinite outline could be detected in the epigastric, umbilical, and right hypochondriac regions. The swelling was smooth, painless, elastic, freely movable with respiration, and could be appreciably displaced in all directions by pressure with the hands. The percussion-note was dull over the centre of the tumour, but sub-tympanitic over its upper third. There was no ascites or enlarged veins.

Inflation of the stomach showed that the viscus was considerably

dilated and lay in front of the upper and left segment of the tumour, and the introduction of air into the colon indicated that the bowel was attached to its right side and lower margin. After a test meal the gastric contents gave a positive reaction for free hydrochloric acid and were devoid of lactic acid. The other organs of the body were apparently healthy. The pain and vomiting of which the patient complained, coupled with the fact that the stomach lay across the upper part of the tumour, seemed to indicate that the symptoms were produced by stretching of the pyloric end of the organ or the duodenum; while the physical characters of the swelling indicated that it was probably a cyst. The patient was accordingly admitted into the London Temperance Hospital for surgical treatment under the care of Mr. Paterson. When the abdomen was opened a large cyst presented itself, over the upper part of which the pyloric end of the stomach and the duodenum were tightly stretched and firmly adherent. The fundus of the stomach was dilated and situated in the left hypochondrium, and the transverse colon extended over the right margin of the tumour. An incision evacuated forty-six ounces of a brownish-coloured fluid, which contained numerous fragments of fibrin of the shape of melon-seeds and two small flakes of black pigment, but no hooklets. The cyst appeared to be situated in the lesser cavity of the peritoneum, and was so firmly adherent to the transverse mesocolon, the stomach, and intestine, that it was impossible to remove it. A drainage-tube was consequently inserted, and after about two months the cavity was almost closed. The vomiting ceased immediately after the operation, and the patient was discharged from the hospital in good health.

Treatment.—In the initial stages of the complaint the pain and vomiting may require to be controlled by sedative drugs, and if the stomach is dilated lavage may be employed with advantage. As soon, however, as a cystic tumour can be detected, an operation should be undertaken, with a view to drainage. An exploratory puncture is more dangerous than a carefully performed laparotomy, and any attempt to aspirate the cyst is a dangerous procedure, as in one of the recorded cases it was followed by fatal peritonitis.

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CHAPTER VII

BENIGN TUMOURS

THE benign tumours of the stomach and duodenum which have not been described in the previous chapters are myomata, fibromata, lipomata, lymphadenomata, myxomata, osteomata, and aneurysms. They are all very rare, and, with perhaps the exception of the first, are practically devoid of clinical interest.

(1) **Myoma.**—This was first described in 1762 by Morgagni, since which time more than forty other cases have been recorded. As a rule it takes the form of an oval or round, firm, solitary tumour situated near the cardiac orifice or at the greater curvature, but it is sometimes encountered in the pyloric end of the stomach or in the duodenum (Wesener). In most cases it does not exceed the size of a pea or a cherry, and occupies the substance of the gastric wall; but occasionally it forms an enormous lobulated or knotty tumour, which projects into the abdominal cavity beneath the peritoneum. On section the growth is found to have originated in the muscular coat, and presents a brown or milk-white colour, and on microscopical examination it is seen to consist of interlacing bundles of unstriped muscle, mixed with strands of fibrous tissue and arranged in concentric layers. The tumour is of slow growth and is usually met with in men of middle age. The submucous variety is prone to undergo cystic degeneration and to become pedunculated, while the subserous form occasionally assumes a sarcomatous character (Brodowski). Kidd reported a submucous fibro-myoma, two inches in length and three-quarters of an inch in width, which involved the cardiac orifice, and Vogel one about the size of an almond which was situated near the lower end of the œsophagus. V. Erlach is said to have removed a myoma from the stomach

which weighed 5,400 grammes, v. Eiselsberg one about the size of a man's head, and Kunze a lipomyoma 251 grammes in weight.

Symptoms.—Small myomata are not accompanied by any special symptoms unless the mucous membrane which covers them has undergone ulceration or they happen to obstruct one of the orifices of the stomach. In the former case the patient may suffer from pain after food and repeated attacks of hæmatemesis, while in the latter there is dysphagia or periodic vomiting. Herhold has recorded an example of myoma in a woman thirty-seven years of age who for three years had suffered from severe vomiting after meals. The stomach was dilated and the vomit contained free hydrochloric acid. An

FIG. 68.—Papilloma of the pylorus. (Museum of the Royal College of Surgeons.)

exploratory operation showed the existence of a myoma about the size of a hazel-nut, which had produced obstruction of the pylorus. The duodenal myoma described by Wesener was accompanied by vomiting and emaciation, and the signs of dilatation of the stomach, which caused it to be mistaken for cancer of the pylorus.

The subject of Kunze's case was a man aged fifty-two, who had suffered from abdominal pain for fourteen years. There was no vomiting or cachexia, but he was extremely emaciated. On examination a tumour about the size of a man's fist could be felt close to the navel, the existence of which had been

known to the patient for four years. It was hard, nodular and painless, slightly movable, and sub-tympanitic on percussion. No details are given of v. Erlach's case, but since an operation was undertaken and the tumour was of enormous size it must have been accompanied by symptoms of sufficient severity to necessitate active treatment.

(2) **Fibromata.**—Although several cases of 'simple fibrous tumour of the stomach' have been recorded, a careful scrutiny of the descriptions given of their microscopic appearances throws considerable doubt upon their benign nature. In some instances there is every reason to believe that the growth was

FIG. 69.—Papilloma of the pylorus. (Museum of the Royal College of Surgeons.)

ordinary scirrhous carcinoma, while in others it is probable that it was the scar of a former ulcer which had become keloid. In most cases, however, where a circumscribed tumour existed, it was apparently of the nature of a fibro-sarcoma. Thus, in Ware's well-known case a woman at the age of fifty-six suffered from a hard irregular tumour of the abdomen which extended from the level of the umbilicus to the left iliac crest. After death a fibrous growth was found to occupy the anterior wall of the stomach near the great curvature and to be ulcerated upon its mucous aspect.[1] The absence of

[1] *Boston Med. and Surg. Journal*, 1858, p. 83.

symptoms, combined with the fibrous structure of the tumour, appears to have been the main reason for describing the growth as a fibroid, but in the light of our present knowledge it would seem to be fairly typical of fibro-sarcoma (p. 273). We have not been able to find a single case in the whole of the literature where a large fibroid tumour of the gastric wall was above suspicion of malignancy.

(3) **Lipomata** occur as yellow round or lobulated tumours in the wall of the stomach about its centre. As a rule they form well-marked projections upon the inner surface, which vary from the size of a small nut to that of a pigeon's egg, and, being situated in the submucous coat, are covered by mucous

FIG. 70.—Lipoma of the stomach. (London Hospital Museum.)

membrane. In other cases they originate in the subserous connective tissue, and form large and somewhat pendulous tumours on the external surface of the organ, near its lower margin (Orth, Russdorf). Very rarely the growth assumes a more diffuse character and affects a large area of the gastric wall (Read). These tumours are seldom accompanied by any special symptoms, but in the case of the large subserous variety there may be a complaint of weight and dragging, arising from the mechanical displacement of the stomach. It may also be possible to detect one or more soft, smooth, painless, and movable masses on palpation of the abdomen. Both varieties are apt to become pedunculated, and in rare instances they are converted into cysts (p. 339) or acquire a malignant character.

(4) **Lymphadenoma** may affect the stomach and intestines, either in the form of lymphoid overgrowths of the mucous membrane or by invasion from the exterior. In the former case the stomach presents a number of sessile and polypoid tumours, which are very numerous and closely set round the cardiac orifice and in the body of the viscus, but are scanty or even entirely wanting in the neighbourhood of the pylorus. The growths are soft, smooth, and creamy-white in colour, and are intermixed with flattened patches or vermiform elevations of lymphoid tissue. Occasionally they exhibit signs of softening at their bases (Pitt) or of superficial ulceration (Reimer). Cornil observed a gangrenous condition, while Kredel has described extensive ulceration of the cardia, which led to gangrene of the spleen. The upper portion of the duodenum is usually affected in a similar manner, and in one case it presented a growth the size of a Tangerine orange (Coupland). In the small intestine the solitary glands and Peyer's patches are greatly enlarged, and lymphoid masses are often encountered at the ileo-cæcal valve and around the vermiform appendix. In the second variety the growth, which has originated in the mesenteric glands, forms a thick sheath over the intestines, and by invading the muscular coat leads to dilatation of the bowel. If the mucous membrane is involved it often undergoes extensive ulceration. Microscopically, the lymphoid tumours in the stomach consist of mucous membrane which has been thrown into thick folds and is densely infiltrated with large and small lymphocytes, which displace, distort, and compress the gastric glands. The disease is apparently due to proliferation of the normal lymphoid tissue of the part, and often leaves the submucous coat unaffected.

Symptoms.—The two varieties differ considerably in their clinical features. The lymphoid tumours of the stomach and duodenum are equally frequent in men and women, but are rarely met with before middle age, the most notable exception being the case described by Rolleston and Latham in a male infant eighteen months old. In every instance there is a general enlargement of the lymphatic glands, of the tonsils and follicles of the tongue and pharynx, and of the spleen, accompanied by anæmia, debility, and occasionally by inflammation of the pleura. The existence of the growths in the stomach cannot be determined during life, but the disease is occasionally

attended by diarrhœa, and in Reimer's case the ulceration of a tumour gave rise to fatal hæmatemesis. The second variety is far more common in males than in females (9 : 3), and is comparatively frequent in children, five out of the twelve cases which we collected being less than twelve years of age. In every instance there is complaint of severe pain in the abdomen, breathlessness, and intractable diarrhœa; the patient becomes emaciated and suffers from œdema of the feet, and occasionally from jaundice (Coupland), and a well-marked abdominal tumour may be detected by palpation. The duration of the disease varies from five to twelve months, but in young children death may occur within the first three months (Arnott). Although some of these latter cases are undoubtedly lymph-adenoma, it is probable that the majority are really examples of lympho-sarcoma commencing in the mesenteric glands.

(5) **Myxomata** occur as gelatinous semi-transparent tumours encapsuled in the wall of the stomach and covered by mucous membrane. Microscopically they are composed of elongated branched cells, which are embedded in a homogeneous transparent matrix. They are exceedingly rare, and only three instances have been recorded, including one by Hansemann. They should probably be described as myxosarcomata (Ebstein).

(6) **Osteomata.**—Certain tumours, such as fibromata and sarcomata, occasionally undergo partial ossification, and this explanation probably applies to the following case, which is otherwise unique:

Case XLVII. A man, sixty-two years of age, had long suffered from pain after food and other symptoms of indigestion, which developed at irregular intervals and terminated in an attack of diarrhœa. About five months before his death an attack had come on which proved unusually severe. One morning, when in fairly good health, he was seized with violent pain in the epigastrium, accompanied by vomiting, thirst, constipation, and a quick pulse. In the evening the epigastric region was found to be distended and very tender. The vomiting continued urgent, and death ensued about twenty-two hours after the commencement of the pain. At the autopsy the stomach was found to be considerably dilated. Close to the pylorus there was an osseous cartilaginous tumour the size and shape of a quart-bottle cork, which was firmly attached by one extremity to the wall of the stomach, while the other projected into

the pyloric orifice like a stopper. The mucous membrane over the whole stomach was much inflamed.—*Webster*, 'London Medical and Physical Journal,' 1827, 2 N. S., p. 433.

(7) **Aneurysms** are sometimes met with in the coronary and splenic arteries, but they are seldom larger than a cherry and more often about the size of a pea. They are also apt to develop upon the base of a chronic simple ulcer, where their rupture is followed by fatal hæmatemesis (Powell, Sachs, Welch, Rasmussen). Cavernous angiomata and lymphangiomata are also occasionally encountered.

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